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Two groups of children took part in this longitudinal study of eidetic imagery (EI). The New Haven sample consisted of 12 elementary school children, and the Rochester sample consisted of 23 children (aged 7 to 11 years at the beginning of the study). The study was designed to find out some of the qualities of EI and its relationship to memory. An eidetic image was defined as a long-lasting visual image of a figure localized in space in front of the subject, positive in color, and usually on the place where the original figure was shown. The image persists after the stimulus is gone. Subjects were shown pictures one at a time for a brief period and asked to comment on each picture once it had been removed. Study results suggest that eidetic imagery is a stable perceptual ability, without developmental trends as the subject grows older. The amount of information reported on a picture in eidetic imagery differed little from that of normal memory. Study conclusions indicate that EI is a visual phenomena, not merely a report of vivid memory. Additional research is needed to relate EI to perceptual and developmental theories. (MS)

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Final Report
Project No. 5-0361
Contract No. OE 5-10-287

Eidetic Imagery in Children

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Rochester, New York 14627

February 1, 1969

The research reported herein was performed pursuant to a Contract with the Office of Education, U.S. Department of Health, Education, and Welfare. Contractors undertaking such projects under Government sponsorship are encouraged to express freely their professional judgment in the conduct of the project. Points of view or opinions stated do not, therefore, necessarily represent official Office of Education position or policy.

This Final Report has been simultaneously prepared for publication as a monograph and is presently undergoing editorial review (February 15, 1969). The title is "Eidetic Imagery in Children: II. Longitudinal and Experimental Results." The authors are, in order, Jan Leask, Ralph Norman Haber, and Ruth B. Haber. The format of this report is therefore guided by that required by the journal. (Jan Leask, now Jan Fentress, is at the University of Oregon.)

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Bureau of Research

Eidetic Imagery in Children: II.
Longitudinal and Experimental Results

by

Jan Leask, Ralph Norman Haber, and Ruth B. Haber
University of Rochester

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Preface and Acknowledgments

The research program to be described in this monograph was begun by the second author in 1959 while he was at Yale University. Initially, the purpose was merely to locate some eidetic children so that they could be tested in the perception laboratory on several short-term visual storage and short-term memory tasks. These latter experiments were our principal interest and concern. Eidetic children were sought because we expected, somewhat naively it turned out, that they would possess exceptionally long visual storage and short-term memory, as compared to college Ss, or unselected school children. As is often the case, however, the subsidiary comparisons became the principal focus. The difficulty in locating eidetic children, and the striking properties of the images of those children who were eidetic seduced us into a more detailed examination of this phenomenon in its own right. The monograph describes the course of this quest.

In a technical sense, while over 500 children have been tested, and some of them retested up to 10 times, no formal experiments have been undertaken by the project. Rather, much of our work has involved variations in testing conditions, looking for correlates, or retesting for longitudinal changes. The organization of this monograph reflects the methods used and the questions asked, rather than a list of formal experiments. Our results are presented, and our conclusions advanced based on those results. But in a larger sense, most of this work needs to be considered as pilot testing. Some of our earlier work suffered from mistakes or misinterpretations that were not uncovered and corrected until several years later. Further, because our samples of eidetic children were so small, it was often impossible to submit results to statistical tests. Such tests often would have been difficult to interpret in any event, since the population from which the samples were drawn were usually undefinable and unspecifiable. Finally, we did not include non-eidetic samples in most of our work, so that comparisons can only be made within the eidetic sample, or to hypothetical non-eidetic children.

Even granting these limitations, it is hoped this monograph will have an impact on current research and thinking on perceptual development, cognitive development, and visual memory. Eidetic imagery is a measurable phenomenon, even though it does not follow principles generally found in contemporary perceptual theory. Hence, the problem and the interest.

In addition to initial support from Yale University, partial support was provided by a grant from the United States Public Health Service, MH 03244, to the second author from 1959 to 1964. Since then the project has been supported by a contract with the Office of Education, OE 5-10-287, from 1965 to 1968 at the University of Rochester, as well as by support from the University of Rochester directly.

A number of research assistants have participated in this project. These include Jane Williams, who worked on some initial pre-testing in New Haven; Malka Yaari, who completed some of the re-testings in New Haven, and collected the psychological and intellectual tests from the New Haven sample; Bessie Phillips who did the final re-testings in New Haven, and completed the child and parent interviews there; and Ann Sheldon, who did

the initial screening in Rochester, completed both re-testings and collected the child and parent interviews here. To each of these assistants on this project we are most appreciative of their help.

Finally, we want to thank all of the teachers, principals, and superintendents of the schools and school systems involved for their generous willingness to permit us to disrupt school schedules and activities in order to carry out this project. Specifically, we would like to thank Miss May White, Assistant Superintendent of Schools for Elementary Education in New Haven, Dr. Pearl Rosenstein, Director of Pupil Services, Miss Margaret Fitzsimon, Principal of the Roger Sherman School, and each of the teachers of our subjects, for their great assistance in New Haven; Dr. Deller, Superintendent of the Fairport Central Schools, and Mr. Verzella, Principal of the East Rochester Junior High School, for their permission to work in these two systems. Thanks are also extended to Mr. Welch, Principal of the Brooks Hill School; Mr. Verhage, Principal of the Johanna Perrin School; Mr. Dunton, Principal of the West Avenue School; and Mr. Peck, Principal of the Martha Brown Junior High School, all in Fairport, New York.

Summary

Eidetic imagery has been defined as a visual image, representing a previously scanned stimulus, persisting for up to several minutes, and phenomenally located in front of the eyes. While an extensive literature has reported many facets of eidetic imagery, methodological and definitional problems obscure much of the credance of this research. This monograph briefly reviews this old literature, as well as the growing recent body, and reports results of two longitudinal samples and the findings from a number of studies and observations conducted with one of these samples. While the frequency of eidetic imagery in two school populations is very small, the longitudinal data suggests that it is a very stable perceptual ability, essentially unchanged over five years throughout adolescence, with no developmental trends of any kind being uncovered. The studies were designed to indicate some of the qualities of eidetic imagery and its relations to memory. Surprisingly, eidetic children do not seem to use their eidetic imagery to aid their memory; if anything, imaging and memorizing are antithetical means of processing visual stimulation. A detailed examination of the evidence for the visual quality of such imagery strongly supports the view that these few children are capable of maintaining very long visual images, which are quite independent of anything they might remember about the stimulus which elicited them. In fact, contrary to earlier indications, the amount of information content in eidetic imagery quantitatively differs little from normal memory.

Chapter 1

Introduction, Definition, and History

Research on eidetic imagery has had a long history, but a short recent past. While several hundred articles and books have been produced, less than twenty-five of these have appeared in the last thirty years, and most of those have been clinical reports of case histories. This monograph and the paper that preceded it (Haber & Haber, 1964) are reports of attempts to examine eidetic imagery in children, determine its characteristics, the characteristics of the children who possess it, and some of the implications for theories of perception, memory and the whole range of mental functioning and development. Along the way it has been necessary to become embroiled in methodological problems of the measurement of a phenomenon that seems perfectly clear to a few children but is invisible to the observer.

An eidetic image, according to the extensive literature, has been defined as a visual image of a figure, usually long in duration, localized in space in front of the *S*'s eyes, positive in color, and usually on the plane where the original figure was shown. An eidetic *S* can scan the figure continuously during inspection without any interference with the production of an eidetic image, and in fact, scanning is necessary to generate an image of the entire figure. They can also scan their image after the figure is no longer present without their image moving or being destroyed.

Eidetic images have been distinguished from memory by the *S*'s report that a visual image persists after the stimulus has been removed, and by behavior which indicates that he is indeed attending to such an image. There have also been attempts to use amount of detail as a criterion, but as will be seen, this does not work well. Eidetic images have been distinguished from after-images by their persistence (after-images fade rapidly), by their reliability of evocation from even low contrast stimuli (after-images are usually difficult to arouse from such stimuli), by their positive representation of color (after-images, especially long ones are usually negative), by the independence of visual fixation (after-images require fixation to form while eidetic images do not), and by the lack of effect of eye movements during report (after-images move with the eyes while eidetic images can be scanned visually).

At least as examined by non-eidetic perceivers, the phenomenon of eidetic imagery has a strong esoteric aroma to it. Most non-eidetics, especially psychologists, have dismissed it as either a figment of phenomenological psychologists or an atypical hallucination seen only by some disturbed patients. In either case, so the argument has gone, either the observer or the subject must have been hallucinating when eidetic images are being reported. On the other hand, there are good reasons to believe that eidetic imagery might be a legitimate phenomenon, easily identified and replicable, and of great theoretical interest. It was this hope that led us into this work beginning in 1959.

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Current work in perception and perceptual memory is just coming to recognize the possibilities of visual images as a critical stage in the translation of stimulation into awareness, memory, and report. Even so, the nature of such images is not spelled out in theory except that they are not expected to be very long in duration. The concept of the short-term visual storage has been proposed and discussed by Sperling (1960, 1963, 1967), Averbach and Coriell (1961), Mackworth (1963), Haber (1969), and Haber and Nathanson (1968), among others. It serves as a brief storage for short duration stimuli, and permits more time for processing the information in the stimulus. However, these theorists have largely ignored the nature of such images, usually being content to assume that they are like after-images. This is really not surprising since these theorists generally are not interested in images and have no convenient terminology with which to refer to images. A brief discussion of this problem is found in Haber and Nathanson (1968), and a more extensive one in Hebb (1968), and in Neisser (1966). Paivio (1965) has also recognized the role of imagery in short-term memory.

This, then, is the problem, and it will come up in a number of places in this monograph. While the study of after-images involves reports of images, the nature of those reports is highly correlated with the stimulus content, color, duration, contrast, and intensity. Nearly every subject tested (ca 500) reports after-images, including the experimenters. Thus, even though each report is private, no problems arise in the interpretation of the data. Further, reasonable retinal mechanisms have been proposed to explain the determinants of after-images.

None of these conditions are met for eidetic images. Relatively few perceivers report such images, and to our knowledge no experimenter studying it has ever been eidetic himself. Further, the correlation between the stimulus conditions and the reports of eidetic images is not high, even for the few perceivers who are eidetic. Finally, and the most important, no mechanisms have been proposed to explain eidetic images. With the one remote exception noted above (short-term visual storage), the concept of eidetic imagery is almost totally alien to current perceptual theory and thinking.

There has been some interest from time to time by developmental theories in eidetic imagery because of the supposed negative correlation between eidetic imagery and age. The implication was that all children were eidetic at one time, and, further, that eidetic imagery is a more primitive or basic mechanism of visual processing. It might disappear as other processes develop, or be suppressed or trained out because of its interference with reading, cognitive tasks, or abstract thinking. However, developmental implications depend on a correlation with age and upon the high prevalence of eidetic imagery in the general childhood population. As will be shown below, neither of these conditions are met in current findings.

All of these factors notwithstanding, we have been investigating eidetic imagery in children. If the phenomenon can be reliably demonstrated, then it poses serious and intriguing problems for perceptual and for developmental theories. Further, it provides a means of studying imagery in relation to perception in a way that has not been possible in laboratory contexts, since normal images persist for such brief durations. Finally, by looking at the correlates of eidetic imagery some notions can be gained of its causes, mechanisms, and relations to other normal and abnormal cognitive behavior.

The earlier paper by Haber & Haber (1964) made little attempt to review the vast literature on eidetic imagery, and none will be made here. Klüver has three reviews in English (1928, 1931, and 1932), and Jaensch has a major book in 1925 and a second one (translated into English) in 1930. There has been relatively little work on eidetic imagery completed since Klüver's last review.

The general findings of this early work can be briefly summarized. "Percentages of children said to possess some form of eidetic imagery range from 30 to 90 depending upon the age and population sampled, with a rough average of all studies around 50%. Nearly every investigator has reported that eidetic imagery was common and that eidetic Ss could easily be found among any population of children. Different investigators have reported different peak ages; some have indicated a negative correlation with age while others have pointed to puberty or shortly before as the age of greatest prevalence. All investigators reported zero or near-zero frequencies among adults, although as far as is known no longitudinal studies have been reported." (Haber & Haber, 1964, pp. 132-133). However, it is not necessary to read this research closely to see the many serious methodological errors of omission and commission. It is easy to see why psychologists lost interest in eidetic imagery.. They had little evidence with which to convince themselves that the phenomenon was actually present in anyone. As will become clear in the reports of this work, nearly all of the specific criteria for eidetic imagery are fallible in one or more respects. This coupled with the lack of well controlled experiments hampers us in this monograph from presenting a neatly argued case that eidetic or any kind of very long visual imagery exists. Yet that is what we want to do since all those who have observed eidetic children describing their images seem convinced of the visual quality of what they are reporting. Much, though fortunately not all of this personal conviction comes from comments of the children, their attitude, or observations made during testing. Whatever the source, however, some passing reference will be made to these during the course of the monograph. This evidence will be reviewed in some detail in a later chapter.

Chapter 2

Overview of the Research Program and Basic Methods

Our initial intention was first to locate a large sample of eidetic children and then to test them on a number of perceptual tasks in the laboratory. From pre-testing, however, it became clear that eidetic children were going to be rare at best. Hence, the first focus was to find enough eidetic children for further work. To do this, a detailed review of the literature on testing and measurement procedures was made, and a new procedure was standardized by pretesting. With this procedure, two basic samples have been used for all of the work done by the present authors: one from New Haven, Connecticut, and the other from the Rochester, New York area. In addition to these, the recent work of several other authors will also be briefly reviewed here. In these latter cases, their samples will be described when their work is discussed.

New Haven sample: All Ss were students in the Roger Sherman Elementary School of New Haven during the academic year 1961-1962. The school had 245 children registered, of whom 179 were tested during that school year. Those missed were either consistently absent (N=14) or because of time pressures were not included in the random samples drawn from the lower grades. Of the 179 Ss tested, 28 were not scorable due to malfunctions of the tape recorder, leaving 151 in the sample. The school is located in a racially and ethnically mixed lower middle class neighborhood.

Early in the next school year (1962-1963) each of the 12 children who were classified as eidetics, 25 other children with some non-eidetic imagery, and 15 control children were retested. The 12 eidetic children were retested again in 1963-1964 and again in 1965-1966. These results will be described in the chapter on longitudinal studies.

Rochester sample: In the Spring of 1965 a total of 380 children were tested from three elementary schools in Fairport and East Rochester, New York, using the criteria that had been developed but with a shortened version of the testing procedures. While one school was in a middle class and two in lower-middle class neighborhoods, no differences between them ever became apparent so they will always be described together.

Forty of these 380 Ss were retested six months later. They were chosen because they reported sufficient imagery to suggest that they might be eidetic, although many of them were reporting quite poor negative after-images as well. New pictures were substituted in order to minimize familiarity with the stimuli.

On the basis of these two testings a group of 23 children were selected as showing some evidence of EI. They were all Caucasion (as were the schools), ranging in age from 7 to 11 years. This sample did not appear to be nearly as homogeneous as the New Haven one since a much greater range of eidetic abilities differentiated the best from the poorest eidetic child. For most of the subsequent work done with this group, two somewhat matched subgroups were formed by ranking each child on his ability and placing alternately ranked children in the different groups.

The results for the first two general testings will be described in the chapter on longitudinal results. The experimental testing results will be described in later chapters.

The following paragraphs, describing the basic procedure in some detail, are taken directly from the first published report of this work (Haber & Haber, 1964, pp. 133-138). While a number of variations have been followed, the initial research used these methods.

"S was brought into a small room which contained a table with an easel on it. The easel (30 in. wide by 24 in. high, in a neutral grey finish) was tilted away from S slightly, and had a narrow ledge along the bottom on which the pictures were rested. S was seated 20 in. away from the easel, his eyes level with the middle of it. Room illumination was normal, with strong sunlight blocked by curtains when necessary. A tape recorder transcribed both S's and E's voices.

"The sequence of events was the same for each S. He first was shown a 4-in. red square, mounted on a board 10 in. by 12 in., of the same material as the easel. E placed the stimulus on the easel, left it there for 10 sec., and then removed it rapidly. S reported what he still saw on the easel. Three other colored squares (blue, black, and yellow), always in this order, were presented in a similar fashion. After the fourth square was shown, four pictures were presented for 30 sec. each, in the same manner.

"The following instructions were given to S at the beginning:

> 'We are going to play a game with colors and with pictures. Here on this easel I am going to show you some colors and some pictures, and then we are going to talk about them. When I put a colored square here (pointing), I want you to stare at the center of it as hard as you can, and try not to move your eyes at all as long as I leave the square here. When I take the square away, I want you to continue to stare as hard as you can where the square was. If you stare hard enough, you will still be able to see something there. It is very much like when you stare hard at a light bulb, and then look away--you can still see something out there in front of your eyes. (If any child acted as if he was unfamiliar with this demonstration, he was instructed to try it then with one of the overhead lights in the room.) The important thing is to stare hard at the colored square then I put it on the easel--so as to not take your eyes away or move them around. When I remove the square, do not look at me, or follow the color as I take it away, but keep staring at the place where it was on the easel. As soon as I take the color away, I want you to tell me what you still see there, if you see anything. You do not have to wait until I ask you--you can begin telling me right away. OK, here is the first colored square.'

"E was watching carefully during the exposure to be sure S did not move his eyes. If S reported that he saw nothing at all after the square was removed, he was encouraged by bying assured that it was all right to see things after the color was removed. If he still said he saw nothing, he was reminded to stare hard, and not to move his eyes at all, and he was questioned again as to whether he knew what these instructions meant. Then E presented the next square, increasing the duration by 10 sec. over the previous exposure.

"If S said he saw something, he was allowed to report spontaneously. When he stopped, he was questioned on whichever of the following items he had not reported: Was the image still visible? What was its color and shape? Did color and shape change, and if so, how? In what direction did the image move? How did it disappear? Did it move when the eyes moved (S was instructed to try to move his eyes to the top of the easel)? After these points had been covered, and the image had faded completely, E gave the initial instructions again, and showed another square. The same procedure was followed for the four squares.

"After the last square was shown and S had finished his response, the instructions for the pictures were given.

> 'Now, I am going to show you some pictures. For these, however, I do not want you to stare in one place, but to move your eyes around so that you can be sure you can see all of the details. When I take the picture away, I want you to continue to look hard at the easel where the picture was, and tell me what you can still see after I take it away. After I take it away, you also can move your eyes all over where it was on the easel. And be sure, while the picture is on the easel that you move your eyes around it to see all of the parts.'

"All four pictures were presented for 30 sec. each. E watched closely to be sure the pictures were scanned and not fixated. The first picture was of a family scene, black pictures pasted on a grey board to form a silhouette. The second, constructed in the same way, was of an Indian hunting, with a deer, other animals, and some birds (reproduced in Fig. 1 below). The third, in full color, showed an Indian fishing in a canoe, with many fish in the water. The fourth, also in color, from Alice in Wonderland, depicted Alice standing at the base of a large tree staring up at the Cheshire cat (reproduced in Fig. 2 below). A number of other similar pictures had been used in pretesting and in extra testing with some of the same Ss.

"After the first picture was removed, S was told to continue to look at the easel, and to tell E whatever he could still see. S was reminded that he could move his eyes. If S reported seeing something, E asked if he was actually seeing it then or remembering it from when the picture was still on the easel. E asked frequently if he was still seeing it, since Ss often would not report the fading of the image but would continue reporting it from memory. If S stopped his report, E asked if he could see anything else. If S said no, but said he was still seeing an image, E asked if he could describe anything else about that image. E probed for further description and attributes of all objects still visible in the image. S also was asked to move his eyes if he had not done so spontaneously. E noted the relation between direction of gaze and details of report. This process was repeated for all four pictures. The average time for testing varied from 4 or 5 min. with a young S having no visual imagery to more than 30 min. for an older S with extensive imagery.

"To score the tape recordings, they were encoded onto specially prepared data sheets, which indicated the content of all responses (images and memory). A different coding sheet was set up for each stimulus. The reliability of this condensation of the data was nearly perfect, since the coding sheets had categories for every object and most of their attributes for each stimulus; the coder rarely had to make any scoring decision. All further scoring was done from these data sheets except the durations of responses, which were taken directly from the tape recordings."

These procedures were used as described with the New Haven sample and in a slightly abbreviated form with the Rochester sample. Much more detailed testing and observation was carried out in all three schools in the Rochester area during 1966-1967. Each child was seen five times on the average over a nine month period. Sessions generally lasted an hour to an hour and a half, and were conducted in rooms provided by the schools. The children seemed delighted to be excused from classes and appeared quite motivated to cooperate with the E.

Many of the results to be described were collected in formal experiments--most, however, were not. Orders of observations usually were not counterbalanced in the sessions in which a number of tasks were presented; control children (non-eidetic) were rarely used for comparisons; and many of the most intriguing findings rest on incidental observation rather than on formal analyses.

The general procedure was similar for each session. The S was excused from class and brought into a room provided by the school. He was seated either at a desk in front of a gray easel set at a distance of 20 inches, or in front of a screen, 15 feet away. The E sat to his left slightly in front and facing him so that the S's eye movements could be observed during the scanning of the stimulus and the report of the EI. Instructions were prepared before each session and were read to the S. The stimuli used in each of the experiments were selected with consideration given to meaningfulness, clarity of detail, colors, and appeal of subject matter for children. (Numerous examples of the different stimuli are reproduced in figures in the text.) The visual angle of the different stimuli placed on the easel 20 inches from the S ranged from 12 1/2° to 34°, with the majority around 20°. For the rogues gallery (see Figure 10 below), the visual angle of each for the 25 rogues was 4 1/2°. In each case, considerable scanning would be needed to clearly register all the details of the stimulus. This would also be true of the size of each rogue, even though the stimuli are considerably smaller. When the stimuli were slides, they were projected onto a screen approximately 15 feet from the S, all subtending a visual angle of 10°. The stimulus slide was always preceded by a milk-white transparency slide that illuminated the same area on the screen. The temporal interval between the transparency and the stimulus was approximately 0.5 seconds - the time required to move the carriage on the slide projector. During this interval the screen was not illuminated, and there was the impression of movement as the transparency was removed and the stimulus placed on the screen. All sessions were tape recorded. Although a stop watch was used during the sessions to record image durations, all scorings of EI durations were made from the tape recordings. At the end of each session the S was thanked for his cooperation and told that the E would see him again in a few weeks. Since nearly all of the observations or tests took less than a full session, several different tests were usually combined in a session.

Chapter 3

Basic Qualitative Results

In the original study (Haber & Haber, 1964), eighty-four of the 151 Ss (55%) reported images of at least one of the pictures. As might be expected, a positive relationship between accuracy and duration was found, although the only Ss who had both good accuracy and long duration scores were those who saw images of all four pictures. The 12 most extreme Ss in that group were discontinuous from the remaining 72 Ss on several measures. They were the only Ss who saw four images, all 48 of which lasted over 40 seconds, all of which had an accuracy of 6 or greater on a 9 point scale of fidelity to the stimulus (the majority were 8 or 9), 90% of which were positively colored (as compared to 34% for the remaining Ss), and 100% of which could be scanned with the eyes (as compared to 2%). Since this last score had been proposed as a criterion to distinguish eidetic images from after images, and because of their better accuracy and much greater duration, these 12 Ss seemed to be reporting eidetic images of the pictures, while the remaining 72 Ss seemed to be reporting after images or weak visual images of some other kind. Given this discontinuity on nearly every measure relevant to a definition of eidetic imagery, these 12 Ss appeared to possess an imagery which was qualitatively different from that of all of the other Ss in the sample. It is on this basis that these children have been labeled as eidetic.

The most striking aspect of the eidetic child's report was the vividness of an image that was "out there" in front of him. There was no qualification in his speech, such as "I think I see," nor did he use past tenses as he might have if he were combining imagery and memory. He was occasionally able to report very fine detail, such as the number of feathers worn by each of the 10 Indians in one pretest picture, though this was not usually the case. One of the clearest examples of eidetic imagery occurred when E showed the next picture, mistakenly thinking that S had indicated that the image to the previous one had faded. After the second picture had been removed, S described her eidetic image, which was clearly a fusion of the images of the two stimuli. She said that she knew this was happening, but was still seeing it.

Before mentioning other results, a few excerpts from several transcripts are included to give a flavor to the kind of reports made that are based on eidetic imagery. The particular examples are from children in the Rochester sample, but similar ones could have been chosen from the New Haven sample.

The following texts were taken from tape recordings of the original screening session with two of the Rochester Ss. The reader should note the elaborate detail given in the reports, but also the major omissions and errors. Of special interest are the accounts of the fading process and the occurrence of fragmentation in Example 4. These examples are not typical of all eidetic reports, but there were many others very similar that could have been used to illustrate the nature of reports of eidetic images. For each example, the picture used to elicit the image is included as a figure. These pictures are often referred to later in the monograph.

Example 1 is by a 10 year old boy to the Indian silhouette (Fig. 1).

Insert Fig. 1 near here

E - Do you see anything there?

S - I can see the cactus - it's got three limbs and I can see the Indian, he's holding something in his hand, there's a deer beside him on his right-hand side - it looks like it's looking toward me and three birds in upper left-hand corner one in right-hand corner, it's larger and a rabbit jumping off the little hill.

E - Can you tell me about the Indian - can you tell me about his feathers, how many are there?

S - Three or two.

E - Can you tell me about the feet of the deer?

S - They're small.

E - Are they all on the ground?

S - No

E - Can you tell which ones aren't?

S - One of the front ones isn't.

E - Tell me if it fades.

S - I can still see the birds and the Indian. I can't see the rabbit anymore. (pause) Now it's all gone.

Example 2 is by the same S̲ to the Alice picture (Fig. 2).

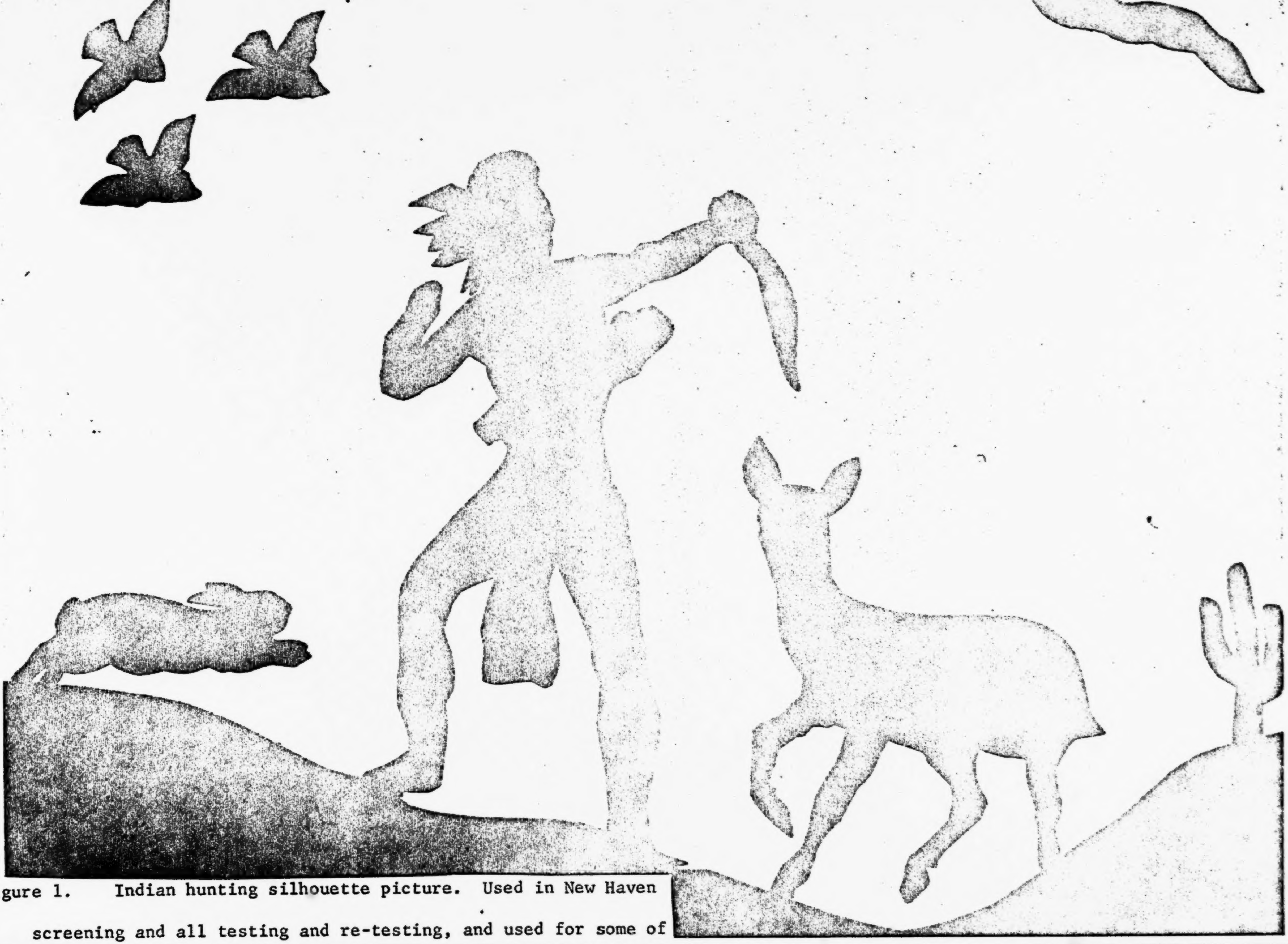
Insert Fig. 2 near here

E - Do you see something there?

S - I see the tree, gray tree with three limbs. I see the cat with stripes around its tail.

E - Can you count those stripes?

S - Yes, (pause), there's about sixteen.



igure 1. Indian hunting silhouette picture. Used in New Haven screening and all testing and re-testing, and used for some of

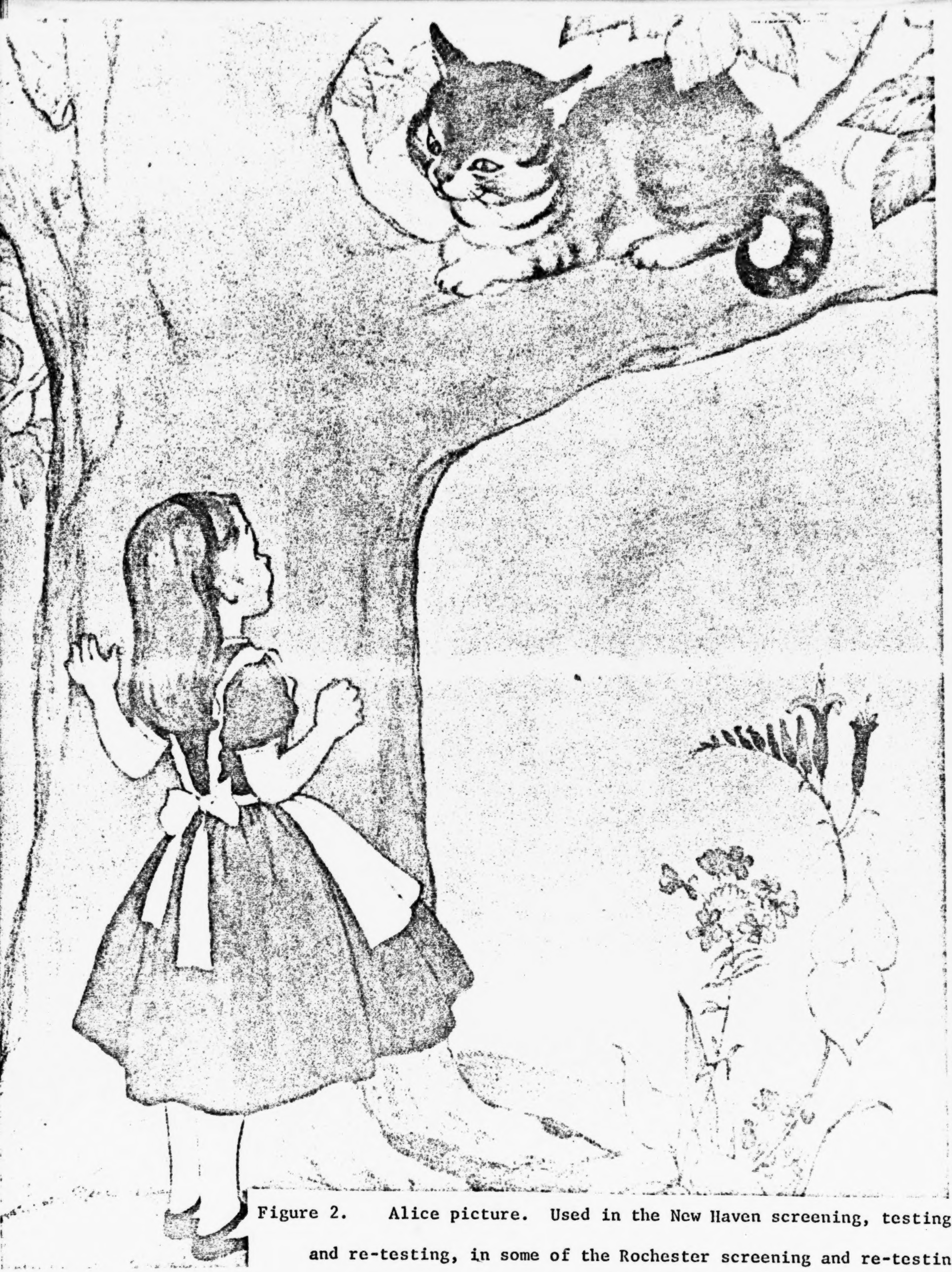


Figure 2. Alice picture. Used in the New Haven screening, testing, and re-testing, in some of the Rochester screening and re-testing and in several experiments.

E - You're counting what? Black, white or both?

S - Both

E - Tell me what else you see.

S - And I can see the flowers on the bottom, there's about three stems, but you can see two pairs of flowers - one on the right has green leaves, red flower on bottom with yellow on top .... and I can see the girl with a green dress - she's got blond hair and a red hair band and there are some leaves in the upper left hand corner where the tree is.

E - Can you tell me about the roots of the tree?

S - Well, there's two of them going down here (points) and there's one that cuts off on the left hand side of the picture.

E - What is the cat doing with its paws?

S - Well - one of them he's holding out and the other one is on the tree.

E - What color is the sky?

S - Can't tell.

E - Can't tell at all?

S - No, I can see the yellowish ground, though.

E - Tell me if any of the parts go away or change at all as I'm talking to you. What color is the girl's dress?

S - Green - it has some white on it.

E - How about her legs and feet?

S - (S looks away from easel and then back again)

E - Is the image gone?

S - Yes - except for the tree.

E - Tell me when it goes away.

S - (pause) It went away.

Example 3 is also by the same S to the Indian and Animals picture (Fig. 3).

Insert Fig. 3 near here

E - Can you see it?

S - Yes, I can see the white and blue sky and the ground has two different shades of green in it with some blue on it .... and I can see two different squirrels, one is gray and the Indian's holding him in his hand and he's eating a nut. The one on the ground - he's red with a white stripe on him. There are three birds in the air - they're green, orange - they've got some red on them.

E - Can you see the birds' mouths?

S - No, I can see the deer and the cloth on the Indian's belt, it has many colors on it, yellow is the biggest color - and I can see his bow he's holding, it's got zigzag red on it.

ss

E - Anything else - any other animals?

S - There's three rabbits - two of them are brown and one of them is white - the one brown and white one are next to each other and there's another brown one in the right hand corner.

E - What are they doing?

S - One over in the right hand corner is jumping and the other two are just standing around.

E - Tell me more about the Indian.

S - Well -

E - Start at the top and move down.

S - Well, he's got a headband on - he doesn't have a shirt on, he's got a belt on with a cloth hanging out which is red, yellow. He's got Indian mocassins on - I think they're brown.

E - Has he got anything else on?

S - No

E - Anything else you can tell me - and tell me if any of the parts go away.

S - The rabbits and birds are going away (pause) and the sky (pause) that's it - it's all gone.

Example 4 is by an 11 year old girl from the Kipling Animal picture (Fig. 4).

Insert Fig. 4 near here

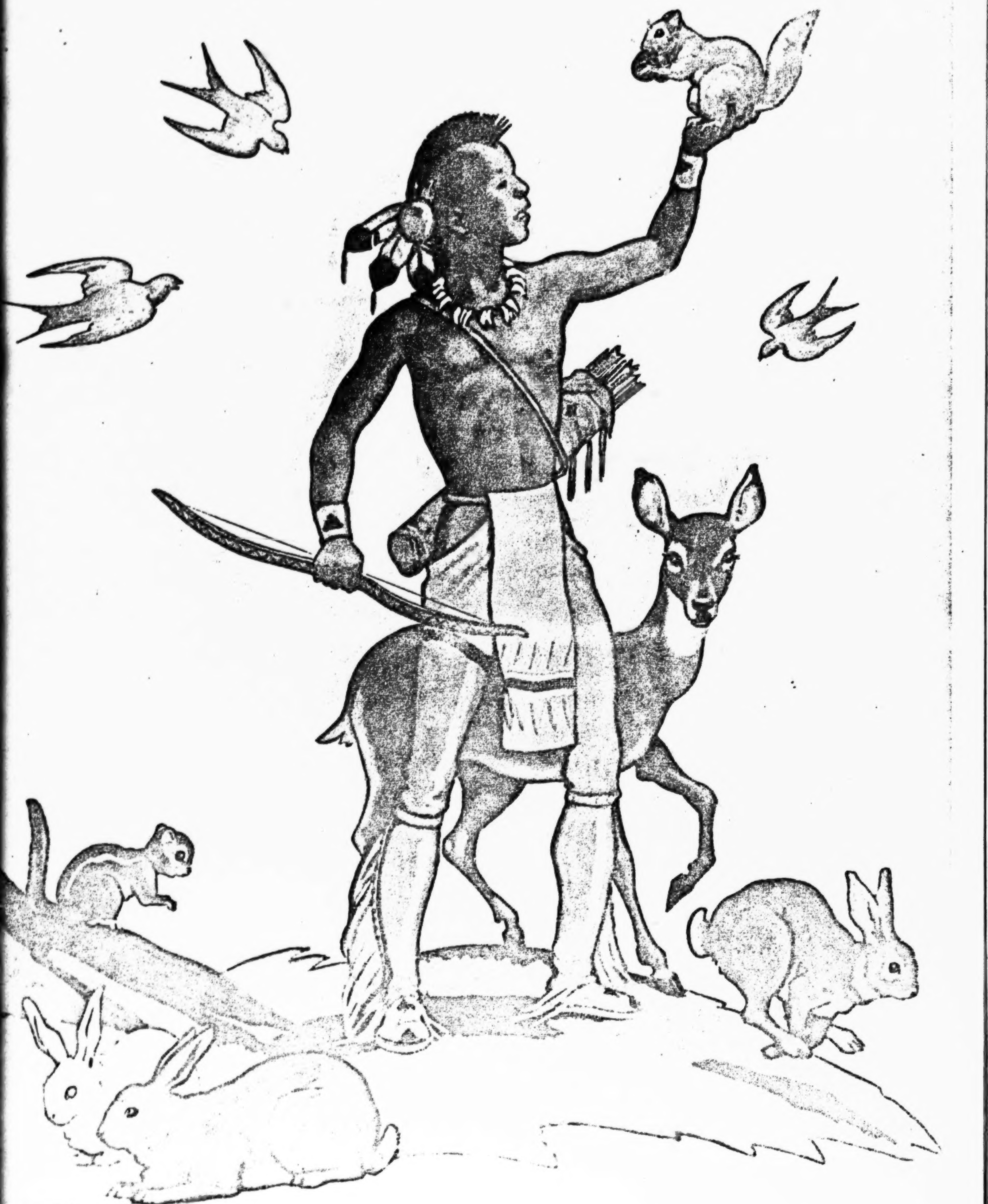


Figure 3. Indian and animals picture. Used in New Haven pre-testing and in Rochester screening and some re-testing.

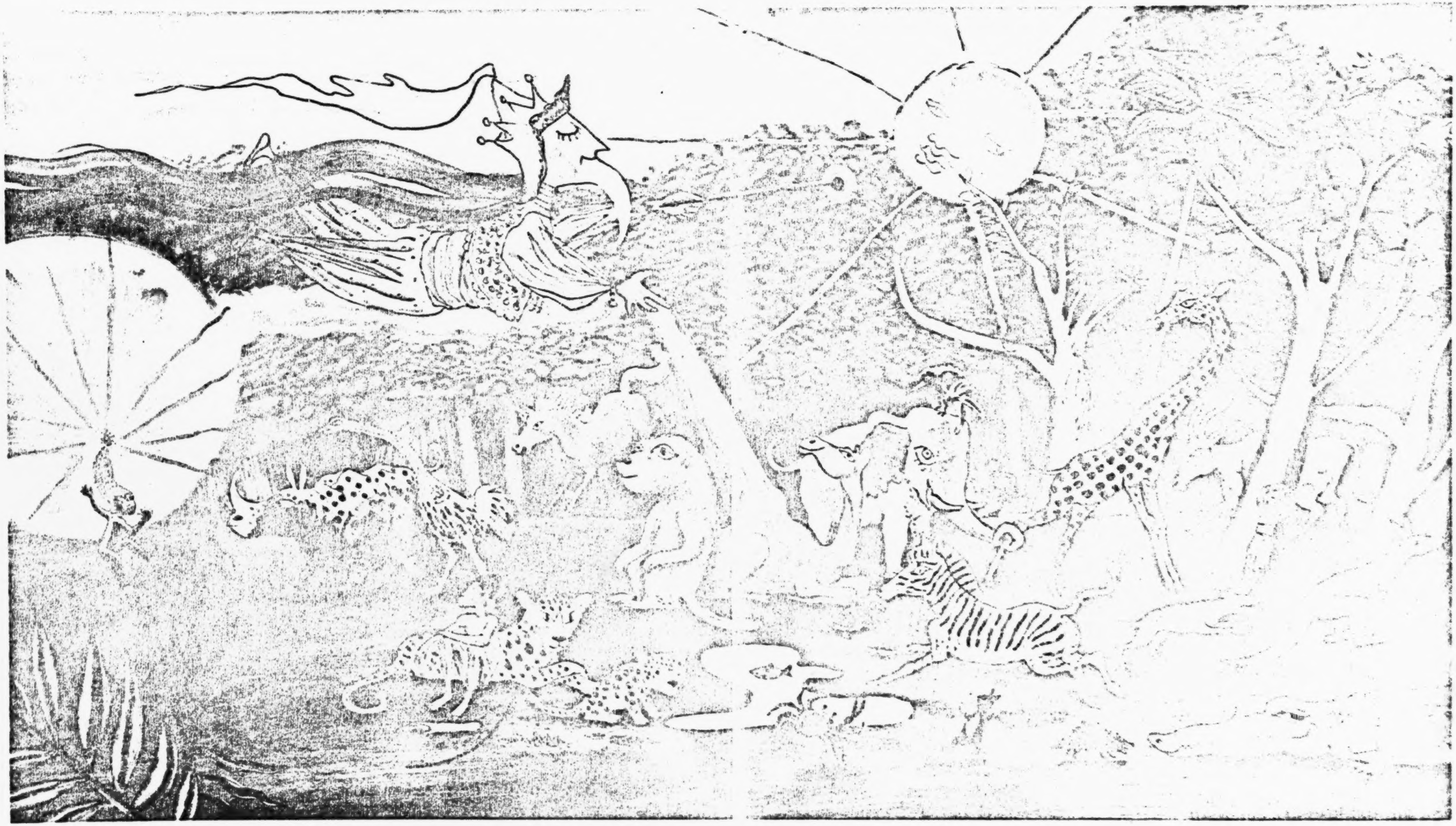


Figure 4. Kipling's animal picture. Used in Rochester screening and some re-testing.

E - Do you see anything?

S - Yes

E - Start at the left and tell me about it.

S - He looks sort of like an elf. He's got a yellow hat and it goes up to a yellow globe - it looks like a sun and the trees behind are sort of bubbly looking - dark green. Ground is dark greenish brown, then there's a momma and a little leopard and there's a native sitting against him. Then there's a pool with a crab on it - coming to it - with a fish in it and I think there are turtles walking in front and a porcupine down near the right hand corner of the pool. Then back on the right, there's a tree that separates a cow in half - the cow's brown and white, and there's something up in the tree - I can't see the bottom right hand corner - there's a sun with a lot of rays on it near the top on the r ight.

E - Can you count the rays?

S - About eight ... (pause) There's a lot in that one.

E - Can you see anything else?

S - No, (pause) there's something red in the tree around where the cow is.

E - Any other animals or people?

S - No more people - can't see the right hand corner. The porcupine has a lot of bristles on it - oh, there's a little something down away from him to the right - it's black and white. (pause) That's about all.

E - Can you still see it?

S - Most of it.

E - Tell me if it begins to go away or if you see anything else. (long pause) Still seeing something?

S - Yes, but not the sky above the trees. I can't see what's in front of the native anymore - it's sort of going, there's something in the left hand corner like a clump of bushes - dark, it's fading.

E - Tell me what parts fade.

S - The right is disappearing - I can still see that cow that's divided by the tree (pause) Oh! There's a crocodile or alligator in the right hand corner. You can't see all of him.

E - Can you see the right hand side better now?

S - No - that's all I see from it.

E - Anything else in the middle.

S - Well, there's the fish in the pool and the pool is sort of odd-shaped, there might be something in back of it.

E - Is there any left now?

S - It's very faint - only the bright yellow of the man's hat - that's about all.

E - Tell me when it goes away.

S - (pause) It's gone.

Example 5 is by the same girl from the Feast picture (Fig. 5).

Insert Fig. 5 near here

E - Tell me what you see.

S - Up above it looks like stairs coming down and then there's a bench and a boy, then a girl and a couple of boys sitting on it, and then there's a very long table and on the table it looks like more plates without anything on them than food. There's people of all kinds sitting around the table and then it looks like a lady serving behind the table and then by the doorway it looks like children just gushing in and there's a clock by that - up in the left hand corner there's a china cabinet and a big hefty woman is putting dishes in there.

E - Which hand is she using?

S - Both of them and there's a coffee pot above the doorway - and then there's a stove,,it's round and white, there's a fire burning with about three logs and there's a mantel around the top of it with four objects on it. Then over by the corner there's a wood place, a wood pile, and a man's hat hanging on a hook and a bench with one boy eating on it, and a hook without a hat on it and then the table - looks like stairs above that corner too. There are lots of children, more grownups at the table.

E - Can you tell me what any of them have on?

S - The woman serving has on a gray dress with some red on it and then there's one man with a little child climbing up into his lap - near the left. There are quite a few bald heads. It looks like children coming in the doorway.

E - Any other furniture?

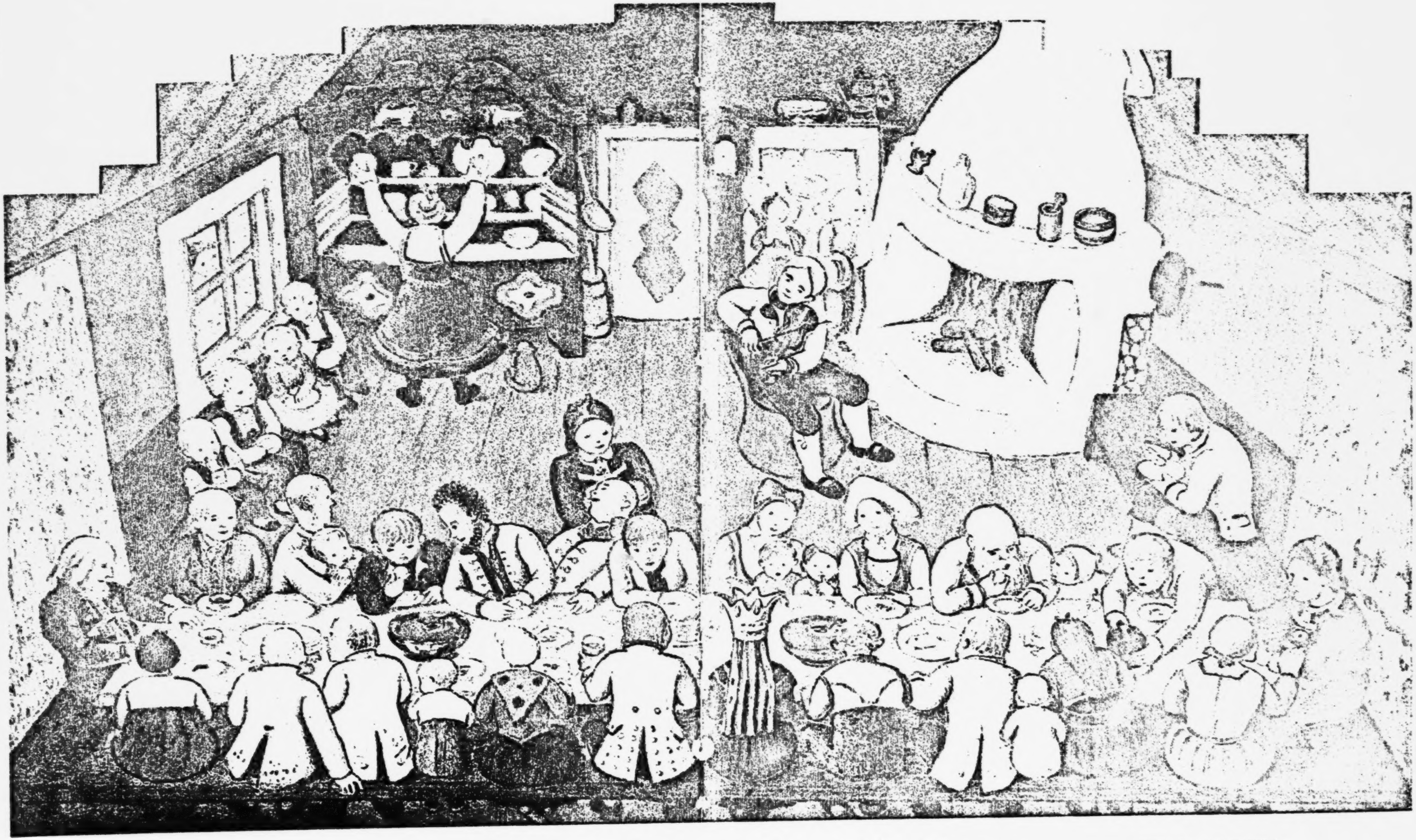


Figure 5. Feast picture. Used in Rochester pre-testing, screening, and some re-testing.

S - No .... Between the clock and china cabinet there's something that looks yellow and it's made in a bunch of Vs. The china cabinet is real pretty and I think there are doors that open up, not too many plates on it. There's fish on the table and something yellow like a casserole. The clock is probably a grandfather clock.

E - Would you go around the table and tell me about the people?

S - I can't tell you about any distinctly. I think there's an old man in the left hand corner ... at the end of the table. I think there's a woman at the other end - can't tell you anything more about the people.

E - Can you still see all these things?

S - Yes, there're a lot of people laughing at the table.

E - Can you tell me about the walls?

S - Where the yellow thing is by the clock, underneath that it's turquoise. By the china cabinet there's a wooden spoon and a broom. In the middle of the picture on the top it squares off, gets flat. It's kinda fading - mostly the table. I can't see it as one whole picture anymore. I can go around and see the different parts. (pause) It's fading - can't see too many colors although I can still see things. There's a window beside the chest on the left and I think there're lacy curtains on it, I'm not sure though. (long pause) That's it.

It was clear to those who tested or observed any of the eidetic children that they presented fascinating challenges for further study and analysis. Even so, the initial results from the study in New Haven showed that eidetic imagery was possessed by only a small percentage of children who were equally distributed in all of the elementary grades 2 through 6 (we found none in kindergarten or first grade). Thus, while eidetic imagery seemed to be an identifiable and reliable phenomena, it is neither widespread nor negatively correlated with age, at least not within the range investigated.

The properties of the imagery itself seemed sufficient to justify a substantial further investment of effort. The remainder of this monograph reports these efforts. The order of topics does not reflect chronology at all but is arranged by the variables or attributes of the imagery being manipulated.

Chapter 4

Distribution, Persistence and Correlates of Eidetic Imagery

Distribution of eidetic imagery: In the New Haven sample, 12 of 151 children (8%) were classified as eidetic. In Rochester 23 of 380 (6%) were similarly labelled. Among a sample of 34 institutionalized retarded children, 9 (27%) were eidetic (Siipola and Hayden, 1965). In seven different samples drawn from different African samples (see below), Doob reports percentages from 0% to 20%. While these numbers show some variability, they are all very small compared to expectations based on the extensive older literature.

The most likely explanation of the discrepancy from previously reported frequencies is in terms of the methodological differences in the techniques used to assess the presence of eidetic imagery. These recent studies used very strict criteria and very careful observation of the behavior of Ss' eyes, as well as their verbalizations. Many experiments in the literature classified Ss as eidetic if they produced any images of pictures. Following this criterion, 55% of the children in the New Haven sample would be eidetic. However, it seems apparent that most of those images were after images--they persisted for very short periods of time, they were usually negative in color, they could not be scanned with the eye, and they included very little detail of the stimulus. Therefore, it is assumed that these low frequendes represent a closer approximation to the prevalence of eidetic imagery in the general population of children than does the previous literature.

The distribution of eidetic imagery by age is also substantially at variance with the older literature. In neither of the large U. S. samples was any correlation found--the few eidetic children were distributed evenly over the grades tested. The African work, with adults as well as children, found eidetics at all age levels, up to age 60. In the 5 years of retesting in the New Haven sample, no losses in eidetic abilities were found, though the oldest child was finishing high school when last tested. Therefore, at least within the ranges tested, no correlation with age is found.

Several serious qualifications are needed. In the two extensive testings, no one older than 12 years was initially screened. Hence, it is possible (though the longitudinal results make it unlikely) that even fewer eidetics would be found among adult samples. Further, in no samples were children less than 7 seriously tested. A few 5 and 6 year olds were tested in New Haven, but the demands of the procedure suggest that the zero frequencies in those groups cannot be accepted at face value. It is still possible that eidetic imagery is prevalent among pre-school age children but has disappeared by age 7. Only with some tests not so heavily loaded on verbal skills can this be determined. At the moment, it appears unlikely, however, that eidetic imagery will be extensively found at any age.

Persistence of Eidetic Imagery- Longitudinal Results: Data from two samples are available for longitudinal analysis: the New Haven sample first tested in 1961-1962 and the Rochester sample, first tested in 1965. These results will be reported separately.

The longitudinal work with the New Haven sample has consisted of a series of eidetic tests, plus child and parent interviews administered after the sample had been tested for the fourth time. Table 1 shows the results from the original testing in 1962 plus the three subsequent retests.

Insert Table 1 near here

The retest tape recordings were scored according to the procedure described by Haber and Haber (1964). Mean scores for the accuracy of the details of the images and their durations for the four pictures and duration of the after images of the four squares are included in the table.

The procedures followed during the four testings were essentially identical with those described by Haber and Haber (1964). The four original stimulus pictures (see Figures 1 and 2 above for two of these pictures) plus the colored squares were presented in each testing. All testings were conducted in the schools with only E and the child present during the session. Since the original set of instructions were administered in each retesting, any factors such as set or suggestion that were present during the original testing were also operative during the retestings. In addition, the S's familiarity with the stimulus pictures was also a confounding factor in the retestings, even though the retestings were separated by 8 months to 2 years. As far as is known, no other contacts were made with these children regarding eidetic imagery during this 5 year span.

The sample has varied little in make up, with only three children being lost due to their families moving away. However, several new Ss have been added at the time of the last retesting. These were siblings of five children in the sample who were either mentioned by sample members as playmates in games involving eidetic imagery, or were children suggested by the parents. Four of the five new children were found to be eidetic. The ages of the sample, including the new Ss, ranged from 12 - 17 years at the time of the last testing (1965 - 1966). Although there is considerable variability within Ss from one retest to the next, only one of the original Ss (#04) would be classified as noneidetic on the last retest. This S was originally the poorest child, since his images were of relatively short duration and of lower accuracy than the other eidetic children. However, at the time of the earlier testings, he had been classified as eidetic.

The four testings for eidetic imagery indicate that the children and the procedures are highly reliable, in that all but one originally weak case have remained eidetic without gross changes in amount or quality of their imagery. This is particularly interesting in view of the fact

TABLE 1

LONGITUDINAL RESULTS FOR NEW HAVEN SAMPLE
Odd numbers - female
Even numbers - male

S NUMBER	AGE IN 1965	YEARS TESTED			SQUARES
Original Ss			Mean Accuracy of EI	Mean Duration of EI	Mean Duration of AI
#01	14	1962	7.5	50"	43"
		1963	7.8	74"	52"
		1964	6.8	108"	55"
		1965	6.3	47"	32"
#02	15	1962	8.8	111"	18"
		1963	----------NOT TESTED--------		
		1964	8.0	116"	46"
		1965	8.3	168"	58"
#03	12	1962	8.8	141"	42"
		1963	9.0	176"	39"
		1964	6.8	139"	41"
		1965	6.8	288"	58"
#04	12	1962	6.3	39"	32"
		1963	9.0	9"	15"
		1964	7.3	44"	25"
		1965	6.3	18"	20"
#05	10	1962	8.3	79"	35"
		1963	7.0	14"	14"
		1964	5.0	28"	4"
		1965	-------SUBJECT MOVED--------		
#06	no record	1962	8.8	200"	50"
		1963			
		1964	------SUBJECT WAS LOST------		
		1965			
#07	13	1962	9.0	126"	11"
		1963	8.5	143"	19"
		1964	8.8	121"	39"
		1965	6.0	78"	28"
#08	15	1962	7.8	55"	16"
		1963	6.0	35"	16"
		1964	------SUBJECT MOVED---------		
		1965			
#09	14	1962	7.0	68"	34"
		1963	------SUBJECT NOT TESTED----		
		1964	7.0	35"	30"
		1965	6.5	276"	81"
#10	13	1962	8.5	58"	58"
		1963	8.5	78"	27"
		1964	7.3	140"	42"
		1965	6.0	95"	64"

TABLE 1 (cont.)

S NUMBER	AGE IN 1965	YEARS TESTED			SQUARES
Original Ss			Mean Accuracy of EI	Mean Duration of EI	Mean Duration of AI
#12	13	1962	9.0	106"	33"
		1963	8.3	21"	26"
		1964	7.0	38"	36"
		1965	7.0	45"	55"
#14	14	1962	9.0	198"	39"
		1963	9.0	113"	55"
		1964	8.5	142"	39"
		1965	6.3	142"	39"
New Ss					
#N-22	8	1965	6.8	71"	66"
#N-23	13	1965	8.3	64"	35"
#N-25	10	1965	7.5	124"	61"
#N-27	17	1965	8.0	129"	41"

that the children's eidetic abilities have survived puberty, a period that the old literature indicated as a peak age after which noticeable decreases in eidetic ability were to be expected. This work finds no support for this hypothesis, but, instead, shows that the possession of eidetic imagery, as defined by our procedures, is remarkably stable over time.

We will return to a discussion of the role of suggestion and familiarity at some length later in this monograph. However, the retesting procedures are by no means elegant in that to whatever extent the child can remember the stimulus pictures from year to year, he perhaps could add a few details from memory while making it seem to the E that he was seeing all of them in an image. We had no reason to believe this was occuring, however. No assessment of this possibility was made during the retestings, although some experimental evidence was collected during the testing in Rochester.

To reduce this possibility, in the longitudinal study of the Rochester sample, different pictures were used for each testing. In the Rochester sample, only two testings are available, separated by about 6 months in May and November of 1965. While most of these children were actually tested many times, only these two were sufficiently standardized to permit comparison (see Table 2 for the results of duration and accuracy of content of the images). Four pictures were used in each testing, with no overlap between the two sets. Due to an error on our part, five children were originally misclassified as eidetic (#28 - #32) and were carried along in the sample until later experimental work with these children revealed the mistake. Three of these Ss were subsequently dropped from the sample, while two Ss (#28 & #32) were retained, since they showed some indication of eidetic ability in the experimental sessions. Fourteen Ss were classified as being strongly eidetic (#1 - #19), while 6 Ss were considered borderline cases (#20 - #27) and were kept in the sample to provide a broad continuum of eidetic ability and a comparison group for the fourteen "good" eidetics.

Insert Table 2 near here

In summary, the children in both samples will quite reliably reproduce the same behavior on each testing. For the New Haven children, this extends over a 5 year period.

Correlates of possession of eidetic imagery: Very few variables seem to be particularly related to possession of eidetic imagery. The most important of these has been uncovered in the work of Siipola. Siipola and Hayden (1965), using procedures and stimuli developed on this project, reported a study with mentally retarded children. Out of their sample of 34 Ss, they found nine eidetics, a substantially larger percentage than in the Rochester-New Haven samples of normal children. When the eidetic Ss were subdivided into familial and brain-injured retardates, 8 out of 9 Ss were found to belong to the brain-injured group. These striking results suggest that some form of brain damage may be present in eidetic children.

TABLE 2

LONGITUDINAL RESULTS FOR ROCHESTER SAMPLE
Odd numbers - female
Even numbers - male

S NUMBER	AGE IN 1965	YEARS TESTED	Mean Accuracy of EI	Mean Duration of EI
#1	10	May 1965	-------Tape was not clear---	
		Nov. 1965	6	47"
#2	9	May 1965	7	58"
		Nov. 1965	6.4	46"
#3	8	May 1965	7	108"
		Nov. 1965	7.8	75"
#4	No record	May 1965	7.5	166"
	S moved	Nov. 1965	8	185"
#5	8	May 1965	7.5	91"
		Nov. 1965	6.6	55"
#6	10	May 1965	9	126"
		Nov. 1965	9	169"
#7	7	May 1965	7	153"
		Nov. 1965	7	113"
#8	8	May 1965	8	125"
		Nov. 1965	7	68"
#9	8	May 1965	7.3	60"
		Nov. 1965	7.4	67"
#11	8	May 1965	7.3	47"
		Nov. 1965	6.8	42"
#13	11	May 1965	9	335"
		Nov. 1965	9	495
#15	11	May 1965	9	95"
		Nov. 1965	8.4	90"
#17	9	May 1965	8.5	181"
		Nov. 1965	9	183"
#19	9	May 1965	9	113"
		Nov. 1965	8	113"
#20	9	May 1965	5.5	33"
		Nov. 1965	7.2	60"
#21	11	May 1965	6	27"
		Nov. 1965	5.8	46"
#22	7	May 1965	5.3	46"
		Nov. 1965	5.6	40"
#23	8	May 1965	5.8	26"
		Nov. 1965	6.4	50"
#25	11	May 1965	7.7	74"
		Nov. 1965	5	33"
#27	11	May 1965	6.8	38"
		Nov. 1965	6	41"
#28	8	May 1965	7	36"
		Nov. 1965	6.4	29"
#29	9	May 1965	6	8"
		Nov. 1965	4.6	9"

TABLE 2 (cont.)

S NUMBER	AGE IN 1965	YEARS TESTED	Mean Accuracy of EI	Mean Duration of EI
#30	8	May 1965	6	27"
		Nov. 1965	4.2	15"
#31	No record	May 1965	6	15"
	S moved	Nov. 1965	5.5	16"
#32	10	May 1965	7.5	29"
		Nov. 1965	6	12"

Recently, Freides and Hayden (1966) have been pursuing eidetic imagery in a clinical population of psychiatric and mentally retarded patients. The authors changed the Haber procedure from binocular stimulation to monocular exposure with one eye covered by an opaque eye patch. They found 3 Ss with unilateral eidetic imagery - these Ss reported EI when only one eye was stimulated and not the other. Freides and Hayden suggest that the fragmentation or fading in and out of the EI often reported by eidetic Ss may be due to binocular rivalry caused by lateral differences in eidetic imagery. The authors further propose that "unilateral eidetic imagery may be correlated with unilateral brain damage, and bilateral eidetic imagery with bilateral or basel damage" (1966, p. 88).

While no specific examinations for brain damage have been carried out on any children in the two major samples, numerous other indicators (see below) are negative. It seems very unlikely that much brain damage is present among these children, and any that is there will be so minimal as to be qualitatively different from that dissussed by Siipola and others. Obvious this question has to be followed up much more extensively.

All of the children and their parents from both samples were interviewed after the last testing. For the New Haven sample, each of the children and their parents were interviewed in 1965-1966, primarily regarding their awareness of the imagery and whether it facilitated or interfered with other activities. The child interviews were conducted individually in the schools, and a few weeks later the parents were interviewed in their homes without their children being present.

Nearly all of the children were quite conversant about their ability and definitely aware of it - no doubt due to our intervention and four repeated testings. Most of the children indicated that they experienced images outside of the experimental situation (eg. - watching TV or the movies), but could turn off the image by blinking, looking away, or closing their eyes. The majority said that they could not control the rate of fading or bring back an EI once it had disappeared. While approximately half of the children felt that their imagery interfered with reading, the other half experienced no interference or confusion. One child, when asked this question, answered that she had experienced more confusion due to her imagery when she was learning how to read, but did not encounter this problem now.

Although most of the parents were unaware of any special ability in their children with respect to visual imagery, several of them related incidents when their children were learning to read that were suggestive of interference caused by eidetic imagery. One mother remembered that her daughter would look up from the book she was reading and remark that she could still see the words in front of her. Another parent recalled her daughter's difficulties in reading which were characterized by a very slow pace and long pause accompanied by blinking whenever she turned a page. Another child when playing the piano would, after turning the page of her music sheet to the next song, continue to play the first song as if those notes were still on the page. When her mother asked her why she wasn't playing the new song, she would pause, stare at the page, say "oh", and begin playing the new song. Other than these few anecdotal stories, however, the parent interviews were generally uninformative.

No unusual pattern emerged from these interviews - rather the general impression was that of an average group of children whose only peculiarity was the recurrent experience of prolonged visual imagery.

The interviews in New Haven came after four testings for eidetic imagery of the children, several letters of permission sent to the parents, and a psychological and intellectual testing of the children. We did not attempt to interview the children or question them about their eidetic abilities during any of these testings, in order to avoid contaminating the sample more than necessary. However, it must have been inevitable that the children felt singled-out, and became considerably more attentive to their perceptual abilities than they would have otherwise. This perhaps accounts for the relatively great awareness the New Haven children showed when interviewed. The Rochester sample (see below) produced no comparable data.

The results of the psychological and intellectual testing were also uninformative. Nine of the twelve Ss in the New Haven sample were given intellectual and psychological tests at the time of the first re-testing in 1963. No control Ss were run from the same school because it was felt that unless the eidetic Ss were sufficiently homogeneous on some of these tests there would be no point in investing the tremendous effort in further work with controls. Since, as will be apparent, there is no homogeneity among these nine Ss, no controls were sought later.

While it is possible for us to provide extensive data on each of these Ss, based upon the administration of the Wechsler-Bellevue Intelligence Scale for children, the TAT, and the Rorschach, as well as several more specialized tests, such documentation does not appear to be valuable in this monograph. These Ss as a group did not appear to have any characteristics in common. The data were scored andanalyzed by the third author of the monograph who has had extensive experience with these testing instruments on both normal children and those referred for psychological evaluation. Except for the fact that the overall full-scale I.Q. scores were skewed slightly below average (which a control sample might have shown to be typical of that school), these nine Ss look like a random sample drawn from the school, in that they displayed appropriately extensive heterogeneity on every test, sub-test, comparison, analysis, ratio, and difference that we tried. Two of the Ss seemed to have some evidence in their profiles and in differences in their various performance measures that would suggest some organic damage. There appears to be no evidence, at least as measured by a sophisticated analysis of these instruments, to suggest that any of the other seven have organic involvement. Since most of these Ss were around latency age or very early adolescence at the time of testing, the psychological responses showed great involvement with concerns prevalent at that time for typical children. One child, based on these instruments, would be clearly diagnosed as schizophrenic, but that also is probably the appropriate proportion for a sample from the school. There is no hint that as a group these children are more suggestible than one would expect among typical children of these ages. We also specifically examined a number of the sub-tests on which eidetic children might be particularly good or particularly poor. In no case was there any homogeneity present. The children varied as much on any of these particular sub-tests as they did on any of the others for which we had no hypotheses. For these reasons, more detailed analyses have not been carried out, and we also decided not to invest the effort in comparable testing of the Rochester sample.

The Rochester sample also appeared to be a normal group of children in terms of academic ability and school I.Q. scores. One peculiarity that struck us, however, about these children was the large number who wore glasses. We decided to check this and took a random sampling of every tenth child from the same grades as our S in each of the three schools. Using the schools' health records, we recorded the incidence of glasses, eye operations, or any other eye abnormalities for 285 control Ss and our 23 eidetics. We found that eidetic Ss had a significantly greater incidence of eye problems (52%) than did the controls (30%) (Two tailed X^2, $p \geq .02$). The difference was even greater when the sample was reduced to the be eidetics with 9 of these 14 Ss having eye problems. Unfortunately, the school's eye records were not informative about specific problems, since their eye tests serve to detect only gross sorts of disorders. An intensive ophthalmological examination needs to be conducted with each of our eidetics to determine if there is a specific malfunction common to all these children. It may be that these children have some sort of central disorder in their visual systems and that eidetic imagery is, as Siipola has suggeseed, a symptom of brain pathology. This seems like a long shot, however, No comparable data are available from the New Haven sample.

Following the second testing of the children, each of the 23 Ss and their parents were interviewed using the same questionnaires as in New Haven. Both the child and the parent interviews were conducted in the homes under rather poor conditions, since the parents were present during the child's interview and vice versa (this was not true for the New Haven interviews). In contrast to the New Haven sample, the Rochester interviews with the children were uninformative. The interview situation may have been a contributing factor, as the children were probably somewhat inhibited by their parents' presence. In general, the children seemed to be less conversant about their imagery than the New Haven Ss, and the parents were all unaware of their children's abilities. A content analysis was not done on the interviews, since the material was generally vague, and because of the many interruptions, some questions were inadvertently omitted by the interviewer. Although a detailed analysis was impossible, some general points can be gleaned from these interviews considered together.

All Ss remembered earlier tests done in the school for eidetic imagery, and felt that they were still seeing EIs the same way. They all had experienced EIs outside of the experimental testing situation, such as watching movies or TV. Nearly all Ss felt that EI was difficult to evoke. Strategies mentioned to make EI persist included breaking EI into parts and concentrating on each part, staring harder at EI, not moving eyes or blinking, or closing eyes. They did not seem to use EI in games. They reported that the best conditions to elicit EI were lack of complexity in picture, small picture, contrast in picture, and a quiet, dark room. Nearly all were able to turn off EI easily by blinking, looking away, closing eyes, thinking of something else, talking to self, and shaking head. Most Ss experienced no confusion during reading and felt that EI did not interfere.

However, a sizeable minority (6 Ss) did report confusion due to the superimposition of EIs on next page. The general strategy to avoid confusion was to concentrate and look hard at the page. About half of the sample felt they could control the rate of fading. A few felt there was no systematic order to the fading sequence while some others thought there was. Nearly all said they could not bring back an EI once it had faded. Nearly all said that brief looks prevent images, and that the longer they viewed the stimulus, the better the EI. The sample was divided in half with regard to location of EI, half saying it was in front of their eyes while the other half located it in their heads. No S could remember the first time they experienced EI, and none of them had discussed their EI with others. Almost all Ss said they did not use EI, though a few said they found it helpful in remembering pictures, especially maps.

With the exception of the neurological implications (and perhaps the extra eye glasses), eidetic children seem to be randomly distributed on all variables examined. While only a small number of the possible relevant variables have been explored, these include some of the more obvious ones. It should be added that all of the experimenters who worked with these children felt the same way--except for their imagery and its properties, these children all seemed to be among those typically found in any elementary school. Some of the implications of these negative findings will be mentioned in the final chapter.

Cross Cultural Work: A number of studies were carried out in Africa between 1965-1967 by Leonard Doob and one study by Margaret Feldman. Both experimenters discussed with the present authors the procedures and backgrounds of the research and used the same or related stimuli in many cases.

Leonard Doob has conducted a series of studies in Africa among several different cultures using these procedures and criteria. In his first study among the Ibo of Eastern Nigeria, Doob (1964) reported a higher incidence of eidetic imagery (20%, N=45) than was found in the New Haven sample (8%). A more interesting finding was the higher proportion of EI found in the rural areas, especially among the adults, as compared with the urban areas. While there was a tendency for EI to decrease slightly with schooling and age, differences in age, sex, and schooling between the urban and rural samples were not statistically significant. Instead, eidetic imagery appeared most closely related to place of residence.

With the Kamba of Central Kenya Doob (1965) found the same incidence of EI (20%, N=49) as in the Ibo sample. The presence of eidetic imagery, however, was not correlated with performance on a number of psychological tests or with census-type information. Another type of imagery, referred to as "pictorial images" (PI), was also found to be very prevalent in this society. Almost all of the Kamba tested reported these "pictures in the head" which differed from eidetic images in that the PI were not projected onto the screen but were localized in the S head, and they never seemed to disappear whereas the EI would eventually fade. Neither type of imagery facilitated accuracy of report in immediate, short-time, and long-time recall tests. Doob concluded that EI and PI do not necessarily help people to recall the past more accurately, but the imagery does aid them in recalling past events more vividly and with greater confidence.

Doob summarized his two previous studies plus results from three additional African societies in "Eidetic Imagery: A Cross Cultural Will-O'-the-Wisp?" (Doob, 1965). Although the incidence of EI varied considerably from one society to another (eg. - none of the Somali reported extensive EI, as contrasted with a fifth of the Ibo who reported EI), the descriptions of the phenomenon were remarkably similar between cultures. The author also reported some experimental manipulations carried out among the Kamba. Of the four variables investigated, set, defined as exposure to the afterimage test beforehand, was found to facilitate arousal of eidetic images. The presence of EI did not correlate with a "variety of demographic factors or psychological processes" (p.33) nor did it aid accuracy of recall.

Recent work initiated by Doob (in progress) involved the administration of questionnaires on remembering to a large number (N=400) of secondary school students in Tanzania. The sample ranged in age from 11 to over 20 and encompassed 24 different tribes. The questionnaire included open-ended inquiries on how the S remembers a friend's appearance, plus more specific questions concerning images in front of the eyes or in the head. The preliminary analyses reveal that many of the Ss use language strongly suggestive of EI. A more detailed examination of the data is being made. In addition, the same questionnaire is being administered among the Kamba. Hopefully, these large scale questionnaires may afford a better indication of the incidence and nature of EI in African societies than was possible with the small samples.

Some additional African work was conducted by Margaret Feldman (1968) in Ghana during the academic year 1964-1965. Using these procedures, with the exception that her Ss raised their hands to indicate the fading of an image, Feldman conducted an involved series of testings among literate and illiterate children and adults in the town of Winneba and fishing villages nearby. Initial tests and subsequent retests yielded inconsistent and confusing results. The incidence of EI varied from 0% eidetic among 30 illiterate women in Winneba to 6% eidetic of 113 Winneba school children to 69% eidetic among 39 children tested in a village. The retests were even more confusing with several eidetic S becoming noneidetic on the retest, and vice versa. The author cites some examples in which "eidetic" Ss later admitted that they did not have images "out in front" but only "pictures in the head" which, according to the translators, was a "common expression in Ghana and meant a clear remembering". Another "eidetic" S explained that he had faked the experience becaue he thought there might be a reward. Feldman felt that the testing situation should be viewed as a social psychological problem in which various confounding factors operate, such as set, desire to please, anticipation of reward, "response to a European", and semantic confusion over the distinction between "out in front" and "in my head". After considering the bewildering and sometimes contradictory data, Feldman concludes with Doob that EI is "truly a cross cultural will-o'-the-wisp".

These studies were all conducted under far less than ideal conditions, though in many cases, on a par with observations and results reported in other chapters of this monograph. We have summarized very briefly the salient results. However, our feeling is that, interesting as they are, such cross-cultural findings are relatively uninterpretable until such time as more exhaustive examination of eidetic imagery itself has been done.

Chapter 5

Voluntary Control of Eidetic Images

Can eidetic children prevent images from forming and can they turn them off at will? These questions were explored somewhat unproductively in the interviews, so several more direct attempts were made to answer them.

One of the main problems encountered in the initial screening of the schools and early in the experimental work with the sample was the hesitancy of the children to verbalize in detail about their imagery. In an attempt to encourage them to communicate spontaneously, but without the intention of conducting a formal experiment, silent movies were shown to each of the Ss in the first half of the Rochester sample (11 Ss) for four sessions, and they were asked to report verbally what was happening on the screen. In addition, the movie was always preceded by a presentation of 10 pairs of tracings, each pair consisting of an outline of a complete figure (e.g., a clown) on the first sheet and the same figure minus a few details (e.g., clown without hat, buttons, etc.) on the second sheet. The children were shown the complete figure first for 15", and when this was removed the second figure was immediately presented. They were instructed to tell the E what was missing in the second figure. These two procedures, the "missing parts" game and the silent movies, seemed to work fairly well in that the children tended to be more observant and verbal in expressing their visual experiences.

It was expected that the missing parts task would elicit EIs of the first figure, but it soon became evident that the children could prevent EIs if instructed to do so. The E first asked each S if he was able to "get an image" of the picture. All Ss reported images. The E then inquired if the Ss could "not get an image" of the picture even though they looked at it for the same amount of time. Most of the children thought they could prevent an EI but were not certain. One of the tracings was then presented, and the S was instructed to "not get an image" of the picture. All Ss reported that they were able to prevent EIs, but when asked about what they did to prevent their images, the typical response was vague and apologetic. They were unable to explain the process beyond the fact that they concentrated more on the picture when they wished to have an EI.

During one of the sessions with the "missing parts" game the E noticed one eidetic child who, after being instructed to prevent an EI, moved her lips while viewing the stimulus but did not do so when asked to "get an EI" of the picture. Upon questioning by the E, she mentioned that she would not develop an EI if she described aloud what she was looking at while scanning the stimuli. She reported two different strategies that she used for "remembering" visual material: one involved verbal rehearsal and was typically used when she wished to memorize something for school; the second was characterized by concentration upon the stimulus with no verbal rehearsal, and this resulted in an eidetic image. This is further substantiated by spontaneous comments from some of the children in the second half of the sample who were seen a few months after the first half. While performing the "missing parts" task, several of these children volunteered that they found the task difficult if they were asked to get an EI of the first picture and then tell what was missing on the second figure after their EIs had disappeared. According to their descriptions, they simply "looked hard" at the stimulus to develop an EI and could not remember the picture well after the image faded. However, when the instructions were to remember the picture and prevent an EI, they verbally rehearsed the details to themselves while surveying the stimulus. Following removal of the figure, they experienced no images and were able to determine the missing parts in the second picture with ease. Thus, it may be that there are eseentially two separate modes of processing visual information in these children--one being primarily visual and resulting in an eidetic image of the stimulus, and the other involving verbal coding--and only the latter permits memorial representation.

We tried to test this hunch somewhat more explicitly. The Alice picture (see Figure 1) was presented to each S for 30 second with the instructions to scan only those parts that the E mentioned aloud. The E proceeded in a systematic fashion moving from top to the bottom of the picture and carefully observed the S's eye movements to be certain that the child was looking at each part as it was mentioned. The picture was then removed, and the S was asked to report what he saw. Following this, the E presented the same picture again for 30 seconds, but with no verbalization on her part. Instead, the child was instructed to indicate verbally each part that he observed as he scanned the stimulus in a systematic order from top to bottom. The picture was removed, and the S described his image. Finally, the stimulus was presented a third time with the same instructions to the S as in the first presentation. However, the E moved in a haphazard fashion about the picture mentioning details that were spacially unrelated. Following removal of the stimulus, the S was again questioned about his image.

On the basis of the comments of the eidetic children who prompted the investigation, it was expected that the children would not experience EIs after verbalizing aloud during the initial scanning. The results were in the predicted direction in that most of the children reported either partial images or no image when they verbalized. This was contrasted with more complete images that occurred when the E verbally indicated the systematic pattern of scanning. Some of the Ss, however, did report complete images when they verbalized themselves (3 Ss out of 11). The condition involving a haphazard pattern of inspecting the stimulus seemed to have the greatest deliterious effect on the imagery, since none of the Ss described a complete image, but, instead, reported very partial EIs or none at all. It was decided to repeat the procedure using a different picture during the next session. Again, the results were not clear-cut but still were in the direction expected. The condition with systematic scanning and E verbalizing evoked complete images; the condition with systematic scanning but S verbalizing gave rise to only a few complete EIs, and more generally partial images or none; and the condition with haphazard scanning and E verbalizing produced no EI, or only partial EIs with no complete images reported.

One possible explanation for the overlap in *Ss*' performance between the first two conditions, which differed in who verbalized, was the lack of control over scanning time for each element in the picture. When the *S* verbalized, he generally spent a greater amount of time scanning each detail than under the condition in which the *E* determined the scanning time per detail. If this variable was controlled, so that the scanning time for individual elements was equal under both conditions, the results might reveal an even larger difference in the *Ss*' performance. In any case, the results do indicate a tendency for an *S*'s verbalization to interfere with the development of an eidetic image. We will return to this finding in a later section.

Almost invariably when an eidetic child is asked "What did you look at the most in the picture?", the *S* would report the elements that appeared in their EIs and would, upon subsequent questioning, insist that they had only "seen" in their images the parts of the picture that they had looked at. When we looked at this more systematically, in no case did an *S* report something in his image that he had not concentrated upon in the picture. Thus, there appears to be a strong correlation between what the *Ss* looked at in the picture and what they reported in their EIs. This finding is corroborated by anecdotal reports from Doob's work (1965) in Africa. During his persistent questioning of a Kamba man about a missing detail in his pictorial image (PI), the young man vehemently insisted that he was unable to see the detail in his PI because he had not seen it during his initial viewing of the picture. A similar finding is reported by Doob (1966). "Without exception, whenever an informant was unable to "see" a detail in his image, including EI, or when he was told that his report was incorrect, he would offer as explanation for his failure or error the fact that his perception of the picture had been incomplete" (pp. 25-26). Thus, it seems that a detail must be carefully looked at by an eidetic in order for it to appear in his image.

What is particularly important about this process is that an eidetic child can remember details of the picture that he cannot see in the image. Apparently, even though he may not have looked at a part long enough to have it appear in his image, he saw it sufficiently to remember it. The fact that this distinction can be made here by the eidetic children strengthens the assumption that they generally know the difference between seeing an image in front of their eyes and remembering a previously seen picture that is no longer in view.

A common speculation about eidetics concerns their perception of the everyday world. If they have long-lasting visual images of objects they have just looked at, is their world a hopeless muddle of images superimposed over real objects or are they able to avoid this by preventing their images in some way? The work discussed in the previous paragraphs suggests that they are able to prevent their imagery by "not concentrating" on the stimulus. We decided to pursue this a bit further by asking the additional question--are eidetics able to stop their images once they have been elicited?

The Alice picture (Figure 1) was presented several times, with a 30 second exposure for each presentation, to the eleven Ss in the first half of the Rochester sample. Instructions were read to the Ss before each stimulus presentation, pertaining to what S was to do after he had a good EI. For the first presentation, the children were instructed to blink both eyes when the E told them to. For the second, the children were asked to close their eyes for 3 seconds, and for the third, the Ss were instructed to look at the E when given a signal from her. It was found that the Ss could stop their EIs in several ways. For most of the Ss a quick blink made their EIs disappear. Several of the children had EIs that were not affected by blinking, but their images disappeared if the Ss looked quickly at the E and then back at the easel again. In several instances Ss volunteered that they could prevent their EIs if they simply did not concentrate on the picture but thought of something else while they were scanning it.

In conjunction with this problem we also investigated the question of monocular eidetic images. The stimulus was again the Alice picture, and instructions were read to the Ss before each presentation. They were asked to close their right eye and hold a card over it while viewing the easel with their left eye only. The stimulus was presented for 30" and the Ss were instructed to scan it with their left eye. The stimulus was removed, and the Ss reported what they saw without opening or uncovering their right eye. The same procedure was then repeated for the other eye. The results were that all 11 Ss were able to develop and maintain monocular EIs in either eye. In contrast to the three Ss from a clinical population discovered by Freides and Hayden (1966) to have unilateral eidetic imagery, none of our Ss from a "normal" population reported such lateral differences. Freides and Hayden also described several cases of bilateral imagery with "considerable differences in duration and intensity of the images reported for each eye" (p. 88). Contrary to these findings, there were no differences in the Rochester sample between the two eyes in terms of duration of image or accuracy of report. In addition, monocular EIs were as accurate and as long as binocular EIs for the same stimulus obtained at the beginning of the session.

The Ss were then asked to repeat the same procedure, with the exception that after the stimulus had been removed and the Ss reported monocular EIs, the E instructed them to open their closed eyes and look at the easel with both eyes. In all but two cases (out of 11) the monocular EIs disappeared when the Ss opened their other eye. Next, we instructed the Ss to view the stimulus with one eye again. After removal of the stimulus and the Ss' report of monocular EIs, the E asked the Ss to simultaneously close the one eye that they had scanned the stimulus with and open their other eye. In all cases, the EIs immediately disappeared, including those of the two Ss whose EIs were unaffected by the immediately preceding procedure. It should be noted, however, that the closing of the first eye is comparable to blinking, which we found usually makes an EI disappear. Although the problem of blinking is probably a confounding factor, it appears possible that the EI may be generally restricted to the eye originally exposed to the stimulus.

An additional question that commonly arises in any discussion of eidetic imagery concerns the amount of control that the eidetic child has over his image. Is he able to manipulate his EI by moving it around the room and transferring it onto various objects? A number of different pictures were presented to the best 8 Ss, using the standard procedure, and they were asked to move their images onto various objects in the experimental room.

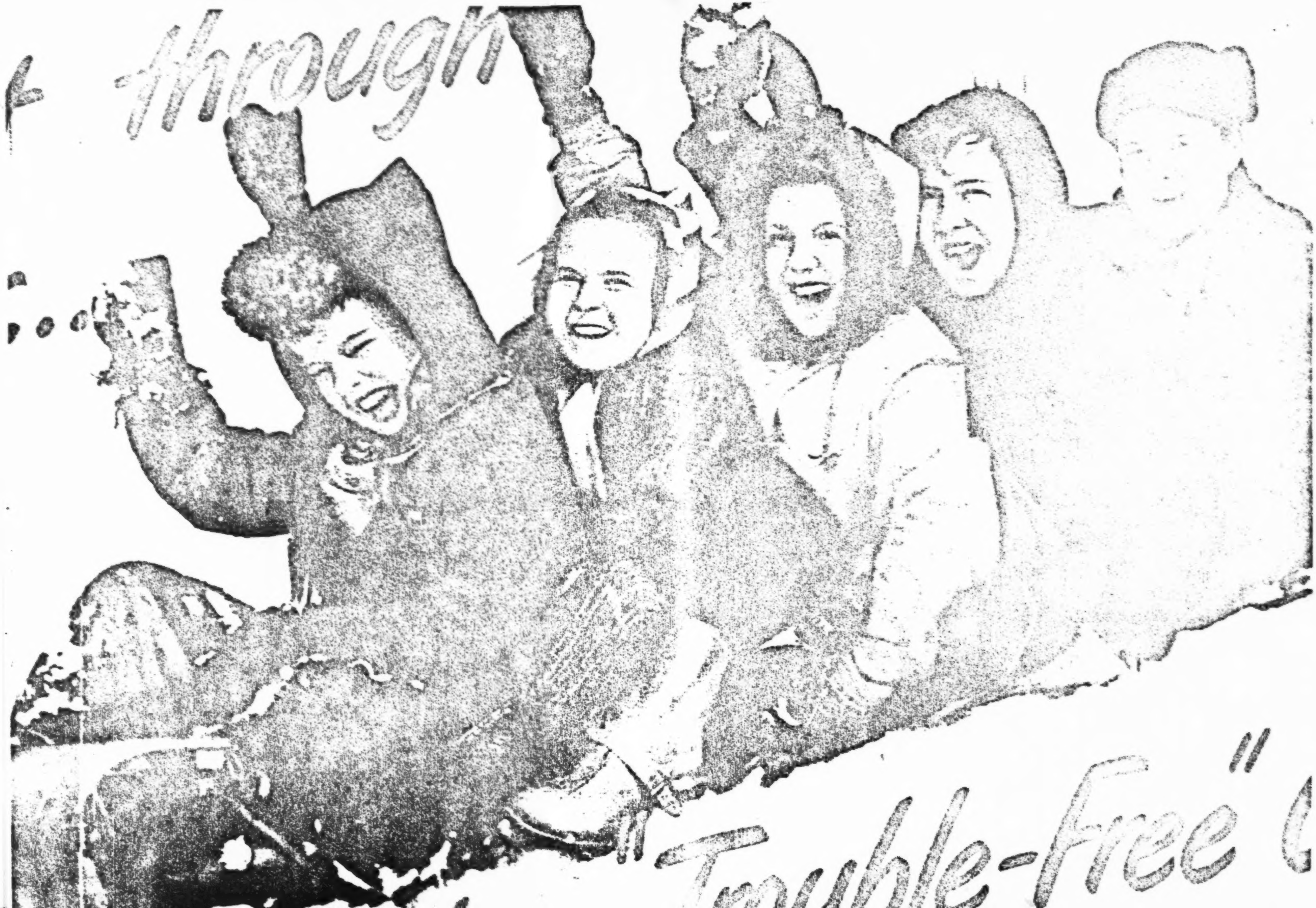
Of the eight Ss tested, only four were able to move their images. Each of these four reported that they accomplished this by moving their eyes and concentrating on their image. The range of ability in transferring the EI varied considerably in these four children. One girl could move her image anywhere--onto the wall, the ceiling, a wall clock, a bookcase, a window pane, etc. Two could move their images around on the gray background but were unable to transfer them to the wall or ceiling, since their images disappeared at the end of the gray card. However, if another background was placed next to the gray card such that there was no space between the two, they could move their images onto the second background. This was done several times using different colored backgrounds. The last was a boy who could only move his EI around on the gray card. His image would disappear at the edge of the card even if another card was placed next to it.

All of the four children could see their images moving as they transferred them, although they reported that their EIs did appear somewhat blurry in transition and after they had been moved. In general, a gap or a change in the continuity of the background disrupted the EI.

While each child can control his exposure to the stimuli around him, we wanted to determine the minimum exposure time that is required to elicit an EI. To do this a colored slide of five children on a toboggan with some writing along the border (Figure 6) was presented on a screen at varying time exposures to eleven eidetic children. The children were instructed to scan it carefully and to continue to look at the screen after it had been removed. The slide was followed by a milk-white transparency slide which illuminated the same area of the screen as the previous slide. The temporal interval between the 2 slides was approximately 0.5 seconds. During the first session a descending series of time exposures was presented using a staircase method. The first exposure was 30 seconds, the next exposure 20 seconds, and so on until no EI was elicited. Criteria for an EI were: (1) image reported; (2) tense, present; (3) location, out there; (4) eye movements, appropriate. The same stimulus was used in each presentation. There were 60 second rest periods after the S reported that his image had faded. During the second session an ascending series was presented with the beginning exposure being one second. Instructions, the stimulus, and criteria were the same as in the first session.

Insert Fig. 6 near here

Figure 6. Toboggan picture. Used in experimental work. It always appeared in slide form.


through
Trouble-free"

The results were fairly clear-cut. A stimulus exposure of 5 seconds seemed to be as adequate as longer exposures in terms of duration of EI, and accuracy and number of details given in the S's report of his EI. There was no difference between the ascending and descending series in the Ss' performances. Although the same stimulus had been presented several times to each S, and their memories of it were undoubtedly quite good, the accuracy and completeness of their reports nevertheless decreased noticeably for stimulus durations less than 5 seconds. The duration of the Ss' EIs also decreased markedly below this 5 second stimulus duration. This pattern was evident in the individual data as well as across Ss.

Even this very cursory examination indicates several mechanisms of control. Eidetic children do not develop images from briefly fixated stimuli or from those they attend to cognitively (e.g., those they label or describe while examining). Once an image is developed, it can be "erased" by an exaggerated eye blink or by attempting to move it off the original surface it was seen on. Since in real life, the object examined usually remains where it is, this would suggest that eidetic children rarely would pick up random images. This agrees with their reports during the interviews. Further, images can be avoided if prolonged examination of stimuli is avoided.

Chapter 6

Eidetic Images of Objects in Space

While very little information was collected on the dimensionality of images, a few observations were made. In one session, various three dimensional objects (a book and several small toys) were used as stimuli with 8 eidetic children. Each object was presented on a table in front of a grey screen. The S was asked to scan it with his eyes for 30 seconds. When the object was removed, he was asked if he could still see anything on or in front of the screen. Three of the top four eidetics reported images that were three dimensional in appearance. These Ss described their images as "sticking out of the screen" and "mid-air between me and the screen." Each of these three children could move their images and reported that they appeared 3-D in the process of transition and after being moved. The exception was one of the better eidetics who reported very poor 2-D images of the 3-D stimuli and was unable to move these EIs. The remainder of the Ss had no images or only partial images so that no judgment could be made as to dimensionality.

A wire Necker cube was also presented during this session. The same three eidetics had EIs of the cube and reported that it changed its orientation in their images. One girl reported an image of the cube in the last position that she had viewed it before the stimulus was removed and was unable to change its orientation in her image. The four remaining Ss failed to develop any images of the cube.

All of the children were asked to report each time the cube changed its orientation when they were scanning the actual cube and when they were viewing their image. During the 30 second scanning period the eight children reported an average number of 5 changes in the cube's orientation. With the exception of one S who reported 11 changes, there was no difference in the pre-image data for the Ss who reported EIs of the cube and for those who did not. The 3 Ss who reported changes in their EIs of the cube reported fewer changes in their image (mean = 3.7) than during the scanning (mean = 6.7).

In general, the imagery elicited by the 3-D stimuli and the Necker cube was poorer in terms of duration and clarity than that reported for 2-D stimuli. In fact, only the very best eidetics were able to develop EIs of these stimuli and they were unable to maintain them for long periods.

One girl, who previously demonstrated remarkable control over her imagery (she could move her EI anywhere, superimpose it over any object, change its size at will, choose to see it or not in the process of transition), claimed that she could also manipulate it by rotating it or turning it upside down. This girl had been noted as exceptional before, since she reported images that would last as long as she wished them to and could bring them back at any time. In fact, she made no distinction between normal memory and eidetic imagery, stating quite adamantly that she always saw an image in front of her eyes when she tried to remember something. We decided to test her claims that she could turn her image upside down. It should be noted that such a test taxes the abilities of experimental psychologists almost beyond the limit of their skills or even imagination.

Two pictures were used. The first one was a silhouette of a tree that revealed a duck in the hollow of the trunk turned upside down (adapted from Elkind, 1964); the other was a line drawing of a man's face that became a different man when inverted (Figure 7). The results were somewhat confusing,

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Insert Figure 7 near here

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since the S did not report the duck when instructed to turn her EI upside down, but did describe the second face quite accurately when given the same instructions. It was felt by the E that the reversible face was too transparent a task, so another eidetic was tested with the picture. The second S also described the face quite accurately when asked to turn his EI upside down. However, he stated that he was unable to invert his image, but could predict what would happen by simply studying his EI in its original position. Therefore, the remarkable control claimed by the aforementioned exceptional eidetic child remains unconfirmed.

In sum, at least a few eidetic children can report three dimensional images, and can even report reversals of their image of a Necker cube. This latter observation, which depends so much on perceptual experience seems to lend further credence to the visual nature of the imagery reports.

Chapter 7

The Information Content of Eidetic Images

In the original testing of the New Haven sample, after each eidetic child finished the description of his image, he was asked to describe his "memory" of the stimulus. Non-eidetic Ss, those who said they saw nothing or only brief afterimages when the pictures were removed, were also asked to report their memory of the pictures. While the accuracy of recall was slightly greater for the eidetic children, the differences were unimpressive, especially considering the great duration their images were available. Apparently, the eidetic Ss were not using the time during which the image was present to encode the stimulus for later recall, nor were they taking advantage of their practice in reporting the stimulus from their imagery. This result is less puzzling when the data from Rochester are considered regarding the antagonism between imagery and cognitive attention to the stimulus.

A number of measures were taken that reflected on memory capacities as related to eidetic imagery. Some of these were concerned with differences between meaningful and nonsense or unorganized material, some with order or direction of scanning, and some with patterns of fading.

The problem of the definition of an appropriate stimulus for eidetic imagery is one that arose early in the work with eidetic Ss. The old literature tended to suggest that meaningful stimuli were much more effective in evoking EIs than non-meaningful or unorganized stimuli. This was also the general impression following the pretesting of the New Haven school children. We chose to investigate this variable of meaningfulness in conjunction with another problem, that of using printed material as a stimulus. This is of special concern with respect to the possible effects of EI upon reading ability. If eidetics do experience images of printed material, one might expect that their development of reading skills would be affected. Thus, we attempted to answer two separate but related questions: are eidetics able to develop EIs of print; and does a meaningful sequence embedded in a longer, nonsense sequence affect the clarity of the EI?

During two sessions three different types of stimuli were presented to each of the eleven children: (1) nonsense letter arrangements composed of 10 letters, three letters of which made a common word (the word was either at the beginning, in the middle, or at the end of the sequence, e.g., MOMQEKAPF); (2) number arrangements composed of 10 numbers, three of which were in sequence, e.g., 2501753789; (3) misspelled words, e.g. GOVNERMENT. During the beginning session 4 cards with nonsense letter arrangements were presented and were followed by 4 nonsense number arrangements. The procedure during the next session consisted of the presentation of a different set of 4 cards with nonsense letter arrangements followed by 4 cards containing misspelled words. Each card was presented to the S, and each letter or number was scanned for 3 seconds. Total exposure was 30 seconds.

All Ss were able to develop EIs of print, but their EIs were, in general, poorer than those elicited by pictures. With print, the responses could be described along a continuum of image completeness, ranging from (1) only a white streak reported, (2) white streak with gray lines reported--no letters were readable, (3) white streak with a few letters that were readable, (4) white streak with all the letters readable. A meaningful sequence embedded in a nonsense sequence did not appear clearer or more distinct in any of the EIs.

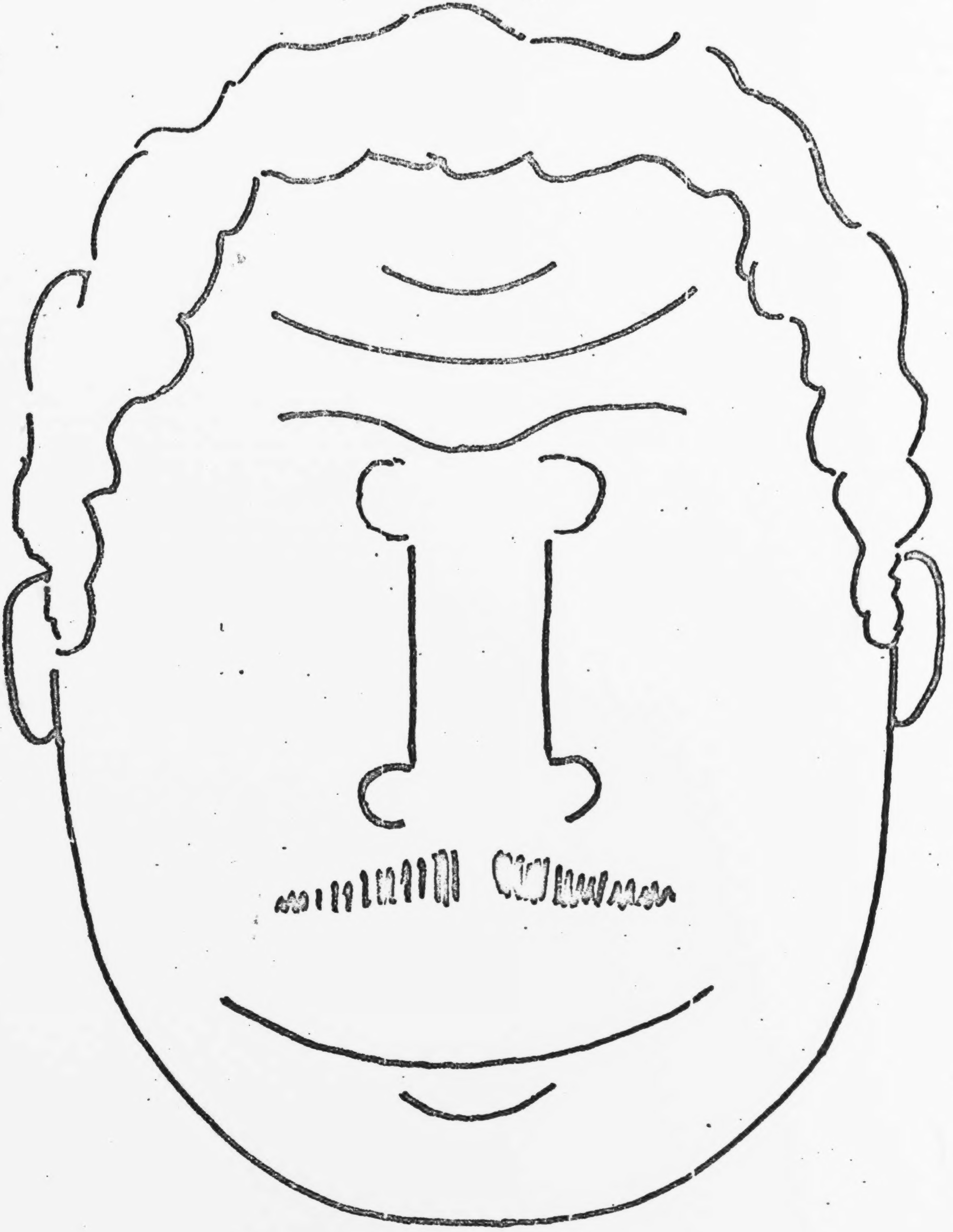


Figure 7. Reversible face outline drawing.

Also, there were no significant differences between Ss' performance on numbers versus letters versus words. In general, clarity was upgraded by recency, in that the last few letters scanned were clearer than the first few scanned. In several cases, Ss were only able to report the last few letters, since the first ones had either disappeared or had faded so that they were unreadable.

During the second session an incident occurred with one of the very good eidetic Ss that was most impressive to us. The stimuli that we used were white cards with a type of prepared black lettering that was rubbed onto the card. Some of the letters, however, had small, barely noticeable cracks in them that had occurred when the letters were transferred onto the cards. After this S had scanned one of the cards with the misspelled word "THOUSEND" on it, he reported the letters that he saw in his image. He suddenly remarked that the O in his EI had "funny white cracks" in it. He seemed quite surprised by this, as he said he had not noted this detail while initially scanning the card.

An additional finding of interest was a consistent pattern of EI fading, evinced in all Ss, that paralled the continuum of EI completeness. The fading pattern, as diagrammed in Figure 8, always followed the same steps, with the final stage being a white streak which eventually darkened to a gray. Thus, if an S developed an EI that consisted only of a few letters surrounded by a white streak, the image would initially fade to a few visible lines with no readable letters surrounded by a white streak, then to a white streak, and eventually to a gray. This is quite similar to the range of EI completeness found in the sample--the poor eidetics reported only white streaks, the better eidetics reported some letters surrounded by a white streak, and the best eidetics described complete images of the sequences, again surrounded by white streaks. The parallel patterns suggest, perhaps, a process of EI formation and of fading, with similar stages that the image goes through as it develops and as it degenerates.

Insert Figure 8 near here

On the basis of these results it was proposed that the Ss with very poor EIs of print might do better if they had longer exposures to each letter. Perhaps, not enough time was allowed for their images to develop completely, and the results we obtained represented an interrupted stage in the development of a complete EI. In an additional session, the letter and number arrangements were again presented to the same Ss. This time, however, a white card with a small window cut into it was placed over the stimulus card such that the S could only see one letter at a time. Varying time exposures to each letter were presented. The first time exposure was 3 seconds per letter. If the S did poorly at this exposure, the duration was increased to 6 seconds per letter and then to 10 seconds per letter. If the S did well at 3 seconds per letter, duration was decreased to 1 second per letter. It was found that the Ss' performance did not improve with increased time exposures up to 10 seconds per letter. Those Ss who developed poor EIs at the original 3 second exposure per letter also did poorly with the longer exposures in terms of duration and clarity of EI.

Figure 8. The pattern of fading of eidetic imagery of letters.

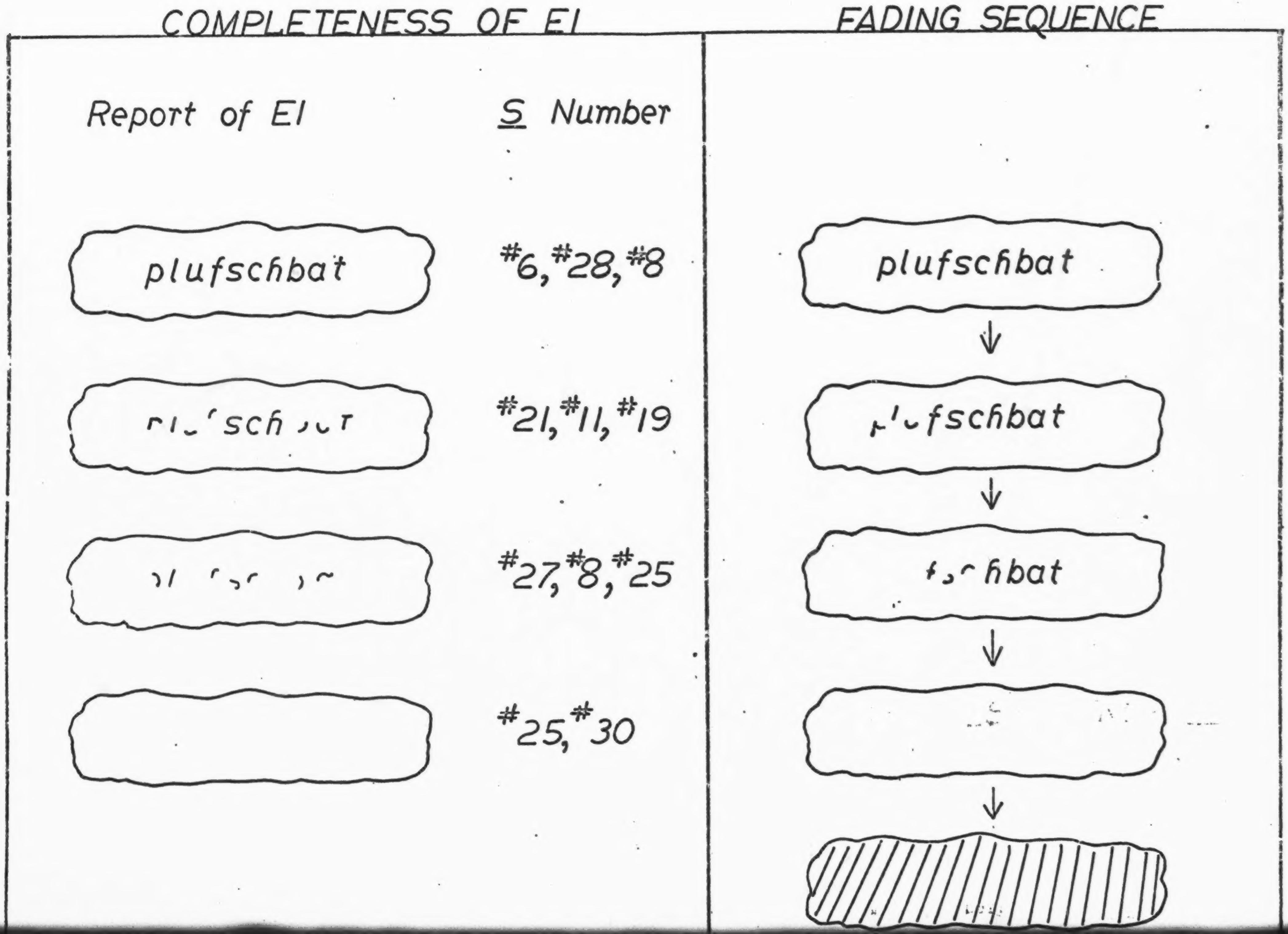
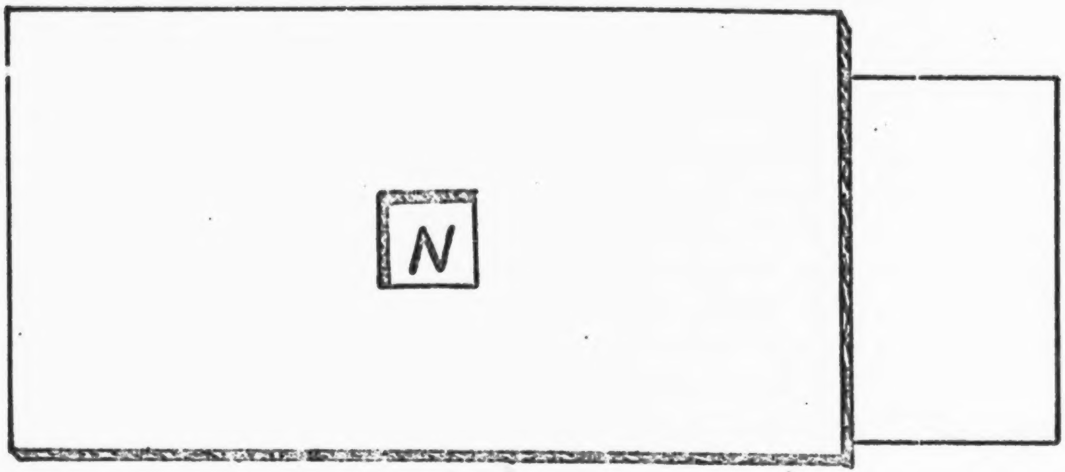
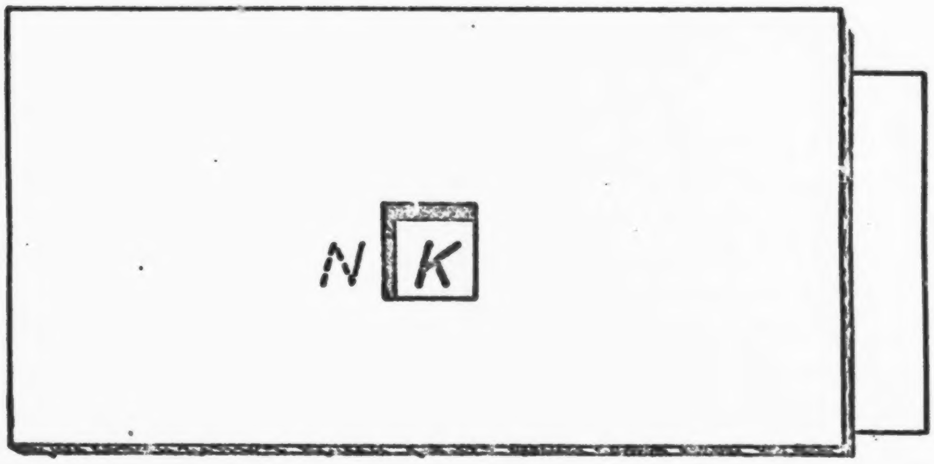

COMPLETENESS OF EI
FADING SEQUENCE
Report of EI
S Number
plufschbat
#6, #28, #8
#21, #11, #19
#27, #8, #25
#25, #30
plufschbat
fschbat
hbat

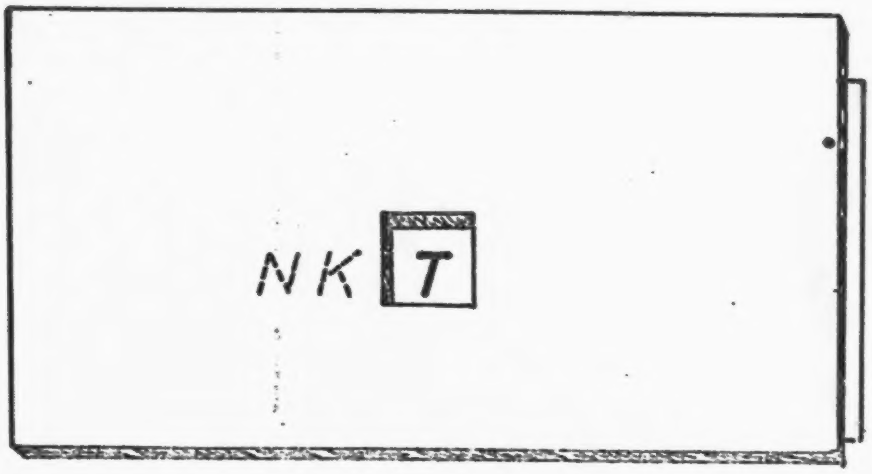
Figure 9. The location of the eidetic images of numbers as seen through the viewing window, a graphic representation based upon the subjects' reports.



A. First letter is exposed through window.



B. EI forms to left of window as card moves to the right to expose second letter.



C. As card moves to the right, EI of second letter forms next to window.

Table 3

Mean Number of Items and Mean Accuracy as a Function of Direction of Scanning and Report

	Condition		Mean Items	Mean Accuracy
	Scans	Reports		
1.	L - R	L - R	6	73.5%
2.	R - L	R - L	5.5	68.8%
3.	L - R	R - L	8	89.7%
4.	R - L	L - R	6.7	66.5%
5.	Aloud L-R	L - R	5.2	60.5%
6.	Aloud L - R	R - L	7.7	80.8%

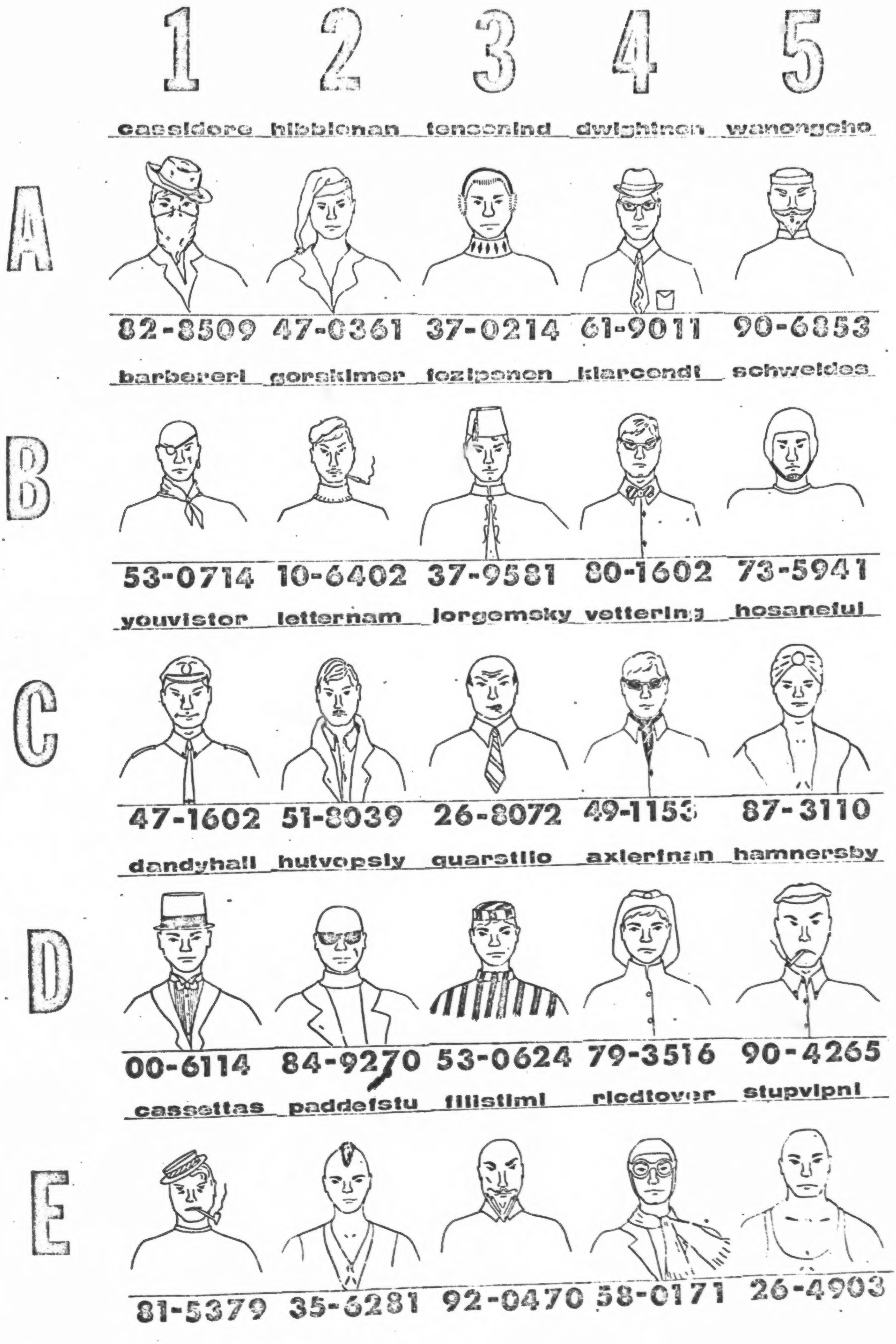
It was predicted that the Ss' reports would be more accurate when the direction of scanning was opposite that of report. This was expected since the letters viewed last should be clearer in the EI than those initially scanned. It was further predicted that this would be the case even when the S read aloud the list of letters--a prediction contrary to what the results from serial learning experiments would lead us to expect. Because of the very few numbers of Ss in this particular experiment, and because not all of them developed eidetic images of the items, it is difficult to present statistical analyses. However, the direction of the differences was quite clear cut, and highly consistent with other results we already have on these eidetic children. Two scores were obtained: the number of items reported from the child's image, and the percent of those items that were correct. These means are reported for each of the six conditions in Table 3. Comparing condition 3 with 1, where the direction of scanning is the same, but the order of report differs, the children can report much more if they do so in the reverse order from that of scanning (89.7% versus 73.5%; and 8 versus 6 details respectively). This presumably is due to the items scanned last being clearest in their image, and hence if reported first are more likely to be correct. This result, by the way, is contrary to the typical verbal learning recall experiment, where a prominent primacy effect is usually found. There is no primacy here at all--the first scanned item rarely persists in an image long enough to be reported.

Insert Table 3 near here

This same effect is found in comparison between Condition 6 versus 5 (in which Ss verbalized the item aloud as they scanned) and of about the same magnitude. However, the absolute size of the scores is slightly lower in 6 and 5 as compared to 3 and 1, suggesting (if it could be tested) that saying the item aloud may reduce the quality of the image. There is similar evidence to this effect reported earlier.

The advantage of reporting in the order opposite to scanning is not found when scanning is done right to left. There is no difference in mean percent accuracy between Conditions 4 and 2, though there is some superiority in number of items reported from the image when the report is in opposite order to scanning. To the extent that R to L scanning is poorer, this would suggest that eidetic children, like most children and adults who read left to right, prefer to scan from left to right, and are more accurate in doing so.

Figure 10. The rogue's gallery.


1
2
3
4
5
cassidore
hibbionan
tenconind
dwightnen
wanongcho
A
82-8509
47-0361
37-0214
61-9011
90-6853
barbererl
gorsklmer
fozipenen
klarcondt
schweldes
B
53-0714
10-6402
37-9581
80-1602
73-5941
youvistor
letternam
lorgemsky
vettering
hosaneful
C
47-1602
51-8039
26-8072
49-1153
87-3110
dandyhall
hutvopsly
quarstilo
axlerfnan
hamnersby
D
00-6114
84-9270
53-0624
79-3516
90-4265
cassettas
paddefstu
filistiml
ricdtover
stupvipnl
E
81-5379
35-6281
92-0470
58-0171
26-4903

It has been proposed that if a child has an image which is visual in character, as contrasted to some kind of organized memorial encoding, he should be able to describe the content of his image in any direction irrespective of the organization of the items given by meaning. Thus, he should be able to name the letters of meaningful words backwards as quickly as forwards, while from memory alone, this should not be true. Unfortunately, we did not try any explicit tests of this prediction with the eidetic children, though a few of the tests mentioned in this chapter are relevant. For example, eidetic children are no less accurate on reporting items from their images of nonsense material, as compared to actual words of equivalent length. The Ss were not asked to report their images of these two types of items backwards. For the tests that did include reports in orders opposite to scanning, only nonsense words were used. Even so, reverse order of report is better, not worse. Its superiority is undoubtedly due to the fading of the items, but at least the eidetic child had no difficulty in reporting items in the reverse order. It must be noted, however, that reporting in the reverse order to scanning is much more pronounced when the scanning is left to right. The eidetic children show no differences in report in either direction when they scan right to left, a direction opposite to normal reading. This seems to show the importance of scanning rather than report order. Before more can be said about this, though, the appropriate experiments have to be undertaken.

We became increasingly concerned with the problem of establishing eidetic imagery as a unique phenomenon different from normal memory. It was suggested by Allen Newell (personal communication) that a new stimulus was needed such that more explicit comparisons could be made between the performance of normals versus eidetics. Requirements of the stimulus were that it must be meaningful, contain a very large amount of infomration--more than could be normally mastered in a short exposure--and be unambiguous with identifiable and countable elements. To meet these requirements a "rogues gallery" was designed (Figure 10) which contained ink drawings of 25 rogues arranged in a 5x5 matrix, each with a name above his picture and a serial number beneath.

Insert Figure 10 near here

The rogues differed from each other along the dimensions of dress, facial expression, amount of hair, etc.

The gallery was presented to each of the eleven Ss in the first half of the sample. The children scanned each rogue for 3"--total exposure was 75". Comparisons were made between accuracy of report of the following: (1) report from memory without a preceding EI; (2) report from EI; (3) report from memory after an EI. The results were disappointing, since the Ss did poorly on the task under all three conditions. Only four of the Ss developed EIs of the gallery, and these images were so incomplete that the children were unable to report much. There is the possibility that the 3 second exposure for each rogue was not long enough to permit an EI to develop. However, many of the children felt that they would never develop an EI of it even with extremely long exposures, since there was too much information to take in. Although the gallery is a meaningful stimulus, it is not cohesive in that it is a composite of 25 separate pictures that do not necessarily fit together. Apparently such a non-cohesive yet saturated stimulus is too difficult and disrupts the eidetic process.

In a final attempt to compare the performances of eidetics and normals, we decided to use a pair of montages (see Figure 11) that Doob had employed in his work with the Kamba (1965). These montages were quite similar to each other, consisting of eight elements each. In order to introduce a range of complexity, we designed two additional pairs of montages, one pair consisting of ten elements per picture, the other containing thirteen elements. Each of these pictures had names that corresponded to the central animal depicted in the montage (i.e., Doob's ostrich and giraffe pictures) and were easily identifiable such that the children and E could specify which pictures they were referring to. The two best eidetics in the sample were chosen as Ss, and a non-eidetic boy and girl were matched with each S for school grade and academic ability. The Ostrich picture in the eight element montage pair was presented to each eidetic S for 30". This was removed, and the Giraffe picture was presented for the same amount of time. After removal, the Ss were asked to report from their EIs. One of the eidetic Ss was able to bring back her EI of the first picture and "view" both EIs of the montage pair side-by-side on the easel. The second eidetic S lacked this ability and was able to see only his image of the second picture. After his image faded, he was asked to recall everything that he remembered about the first picture of the pair. However, the first S was always asked to report in the order of stimulus presentation. With all Ss the E first allowed them to report spontaneously concerning their image or memory of the picture. Following the spontaneous report the E systematically questioned all Ss concerning each item in the montage with regard to its color, location, direction it was facing, and number of details contained in the item. All EIs were of sufficient duration to permit a lengthy question period.

Insert Fig. 11 near here

Contrary to our expectations there were no differences between the performances of the two eidetics as compared to the two controls in terms of number of details given or accuracy of report. This was also the case when the data was broken down into sub-categories of report (i.e., the eidetics did not name more colors correctly or give more locations or details, etc.). In addition, there was no progressive difference in performance within Ss or across Ss as picture complexity increased. In fact, there were no differences in performance between any of the possible comparisons - eidetics vs. controls, report from memory vs. report from EI, memory of first picture vs. memory of second picture for the control Ss, memory of first picture vs. report of EI for for second picture for one eidetic S. It is obvious from these results that the eidetic's "amazing" accuracy is not amazing at all but probably well within the range of normal memory.

There were more qualitative differences, however, that were very persuasive to anyone working with eidetic imagery. When an eidetic child is reporting a description of his image, he does so generally with confidence. His report is rapid and gives every indication that in fact he is looking at the figures he is reporting. When he is asked to report from memory, or when a non-eidetic child is asked to give a report from memory, only the first few comments come in this form, and then there is hesitancy, lack of confidence, impressions of a kind of subjective searching of one's memory for what to say next rather than looking at something to decide what to say next.

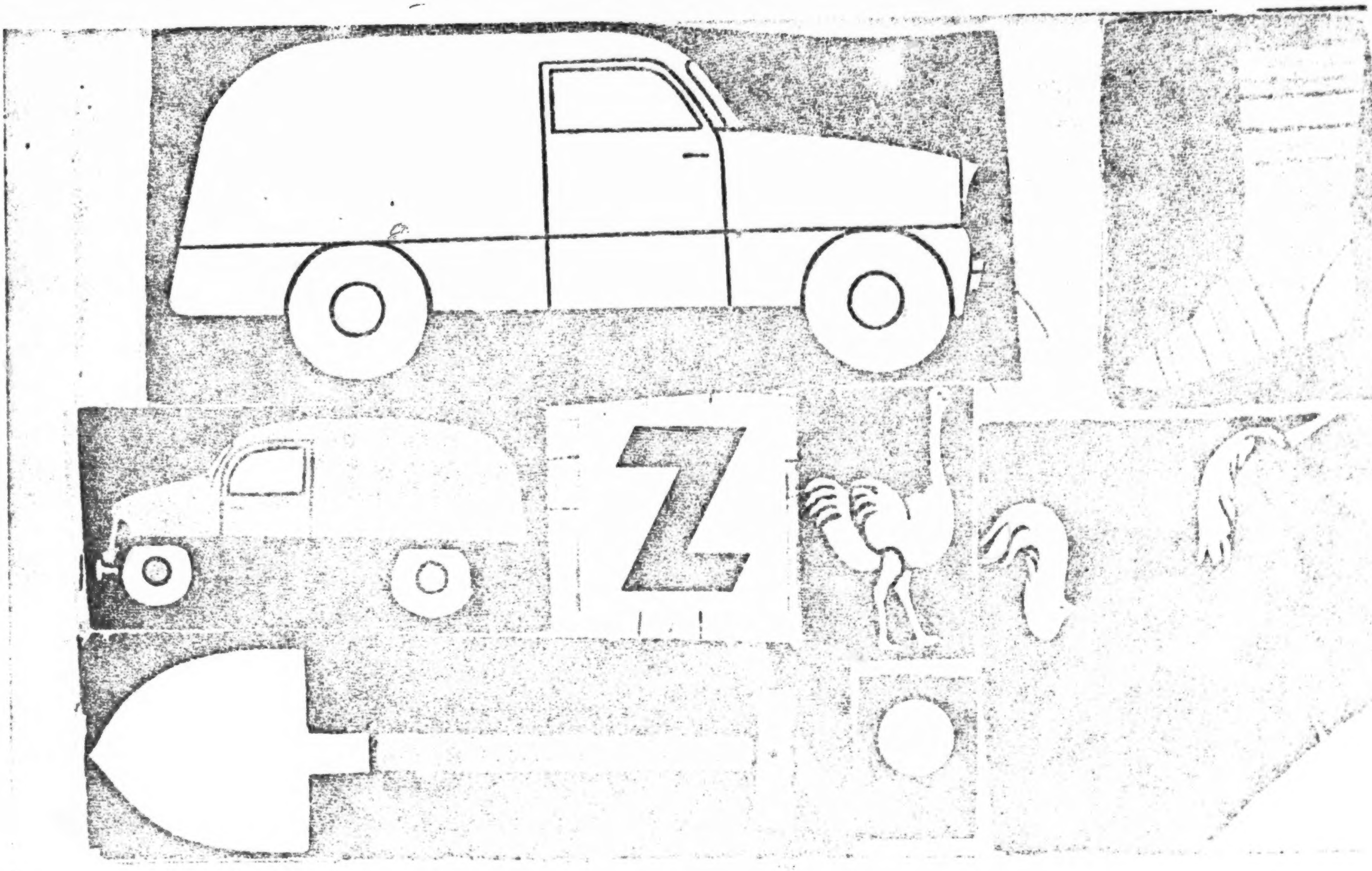
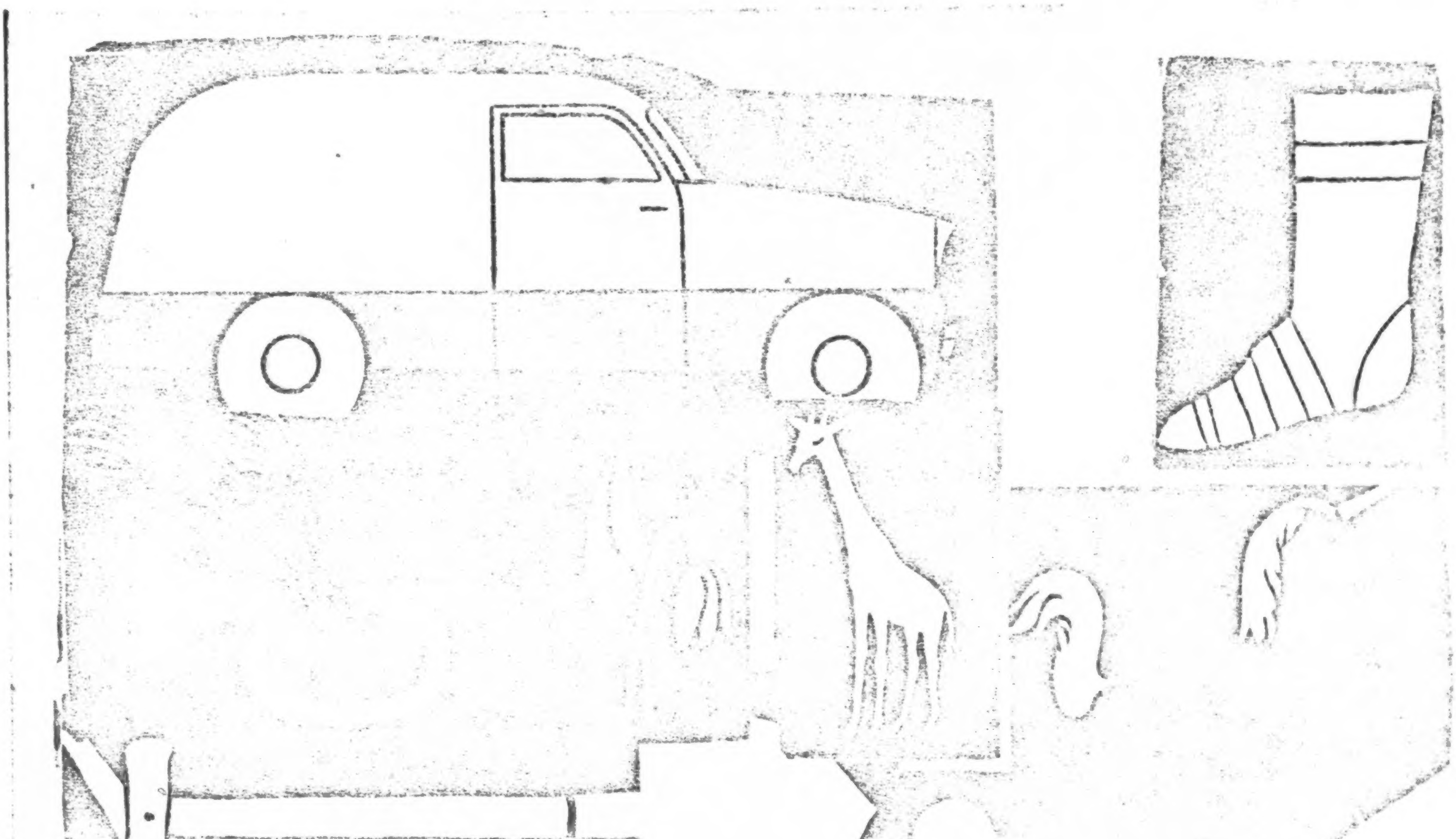


Figure 11. Two paired montages constructed by Doob.



In summary, the exceptional memory claimed for eidetic children fails to be substantiated. If it is accepted that such children have an image they are describing, that image contains a large amount of information--far greater than an afterimage is likely to have--but no more than a response from memory has. We have not been able to undertake quantitative descriptions of the image content as compared to memory content--we do not know if the same or different information is present in an image as compared to a memory of a picture.

While it is no more than a hint, one of the most critical findings could be the alternative modes of processing information found in eidetic children--either they image the picture or they remember it, but apparently not both.

There appears to be no evidence one way or the other as to whether eidetic imagery is one end of a continuum on which memory is at the other end. A brief mention will be made of this in a later section. Suffice it to say, that if the perceptual or visual quality of eidetic imagery is singled out, no continuum would appear to be apparent.

One of the criteria for eidetic imagery that has been prominently mentioned in the older literature concerns its faithful and detailed reproduction of the content of the stimulus in the image. Nearly all of our evidence suggests this criterion to be useless. Leaving aside whether eidetic children can be differentiated from other on any criteria, they certainly cannot on the basis of accuracy of details. While we have found many examples of amazing descriptions of information, the majority of eidetic descriptions contain no more details than would be found in reports from memory alone. In the few direct attempts to compare accuracy experimentally, no substantial differences were found, if any at all.

Therefore, no relationship between eidetic imagery and so-called photographic memory is likely. Nor should eidetic children be selected on the basis of the amount of information in their imagery. The other criteria for eidetic imagery will be examined below.

Chapter 8

Vivid Imagery or Vivid Memory--the Criteria for Eidetic Imagery

At several points throughout this monograph we have made comments regarding evidence for the visual quality of the eidetic image. In this chapter we will discuss these in more detail and contrast this evidence with arguments that reports of eidetic imagery have nothing to do with visual images, but rather are given by children who have very vivid memories. This contrast is of great theoretical concern. We will also examine other more methodological problems such as the possibilities of faking or suggestibility induced by the demand characteristics of the testing situation that could account for the results. All of this discussion is closely concerned ultimately with the criteria for specification of eidetic imagery.

The criteria culled from the older literature or proposed by Haber and Haber (1964) included: (1) the child reports that he sees an image; (2) that image is located in front of his eyes on the plane of the stimulus be scanned; (3) the duration of the image should be substantial, especially longer than is likely from afterimages of comparable stimuli; (4) he uses the present tense to describe his image but shifts reliably to the past tense to describe from memory those parts which have faded or that he never saw in his image at all; (5) he can move his eyes over the stimulus during the inspection of it; (6) he can move his eyes over his image--e.g., he looks on the left side of the surface when describing the left side of the image; and (7) accuracy of details should be high and better than would be expected of normal memory.

Criteria (1), (2), and (3) depend for their validity upon our willingness to accept what the child says as a perceptual report of his visual experience as it is occurring, rather than due to his faking, suggestibility, or response to demand characteristics of the testing. We will discuss this evidence in some detail below. The other criteria are more objective and consequently can be evaluated more directly, though they are of little weight if we have little confidence in the first one.

The tenses used by the eidetic children in their descriptions became a criterion when we noticed in the original screening of the New Haven sample that all of the eidetic children showed a spontaneous distinction in tenses when describing their image as compared with their memory of the stimulus picture. The children would use the present tense while describing their images and would immediately switch to the past tense when referring to parts of their EI that had disappeared. Subsequent consideration of this criterion raised the question that this spontaneous tense change might be due to experimental priming--that is,the E in the process of phrasing his questions might inadvertently indicate the tense to be used. In order to minimize the possible demand cues of the situation, twelve children in the Rochester sample who had not been tested for over a year were retested using the original procedure. The only change was that the E did not use a verb when referring to the Ss' EIs. Thus, the questions were phrased as follows: "Tell me about the color of ____;" "Would you read the writing in the ___;" "Tell me the number of ___." After the child reported that the EI had disappeared, the E asked the child to tell him everything that he could remember about the picture. The same question technique was again employed. The only comparison made was between tense used when the EI was present as compared to the tense used when the EI had completely faded. We did not attempt to study the use of tenses when only parts of the EI had faded.

Briefly, the results were that the children's tense change was not always consistently clear-cut in distinguishing memory from eidetic imagery. Although all but one of the 12 Ss used the present tense while referring to their EIs (the exception was a girl who mixed both the present and past tenses in her description), several of the children continued to use either the present tense (N=3) or both tenses (N=2) when reporting their memory of the stimulus. Six Ss, however, performed as expected--carefully distinguishing between imagery and memory by their use of present and past tneses. It appears that the "demand characteristics" of the situation may be responsible for the tense change in some cases.

One of the problems in interpreting these inconsistencies is the degree to which they are to be expected in the eidetic child. For example, assuming the child is seeing a fairly complete but not perfect image in front of him, it would not be surprising if in his report he inserts details that he remembers but are not part of his image. His memory should be very strong, since he has just been examining the stimulus prior to its removal. Hence, it may be likely that his report will contain remembered but not imaged details as well as details present in his image. For him to report these two sources of information consistently, the child will have to switch tenses.

In any event, this criterion cannot be used as an absolute distinguishing characteristic of eidetic imagery from memory. Most of our eidetic children are consistent, but some are not. Whether these latter children are not eidetic or are even more precise in their reports than we demand is not clear.

Criteria (5) and (6) concern eye movements. All of the eidetic children meet these criteria all of the time they are scanning stimuli and reporting their images. Therefore, their images (if they do in fact have images) cannot be afterimages in the conventional sense. Afterimages seem clearly to be due to differential adaptation of receptor and neural units. Once an image is formed, it cannot be moved over the receptor surface, since it is "burned" on that surface. Further, during inspection of the stimuli, reasonable stable fixation is required to provide the differential adaptation. Since both of these requirements for afterimages are directly opposite to the observations we have made on these eidetic children, it seems most unlikely that their images could be afterimages. Criterion (3), regarding the duration of the eidetic image, also suggests the unlikeliness of these images being afterimages. While afterimages can last several minutes, such is unlikely from these stimulus arrangements.

Criterion (7) on accuracy of details needs to be abandoned altogether. There is no necessary reason for this criterion, and it seems demonstrably indiscriminant. Some images may be complete and contain much fine detail, but others will be fragmentary and consequently with little fine detail. In the few cases in which the amount of detail present in eidetic images is compared to that in memory, no striking differences are found. Further, stimuli that lend themselves to good memories seem poor elicitors of eidetic images.

These comments suggest that criterion (1)--the child says he sees an image--will have to be the major one, with the others added primarily to delineate the nature of the imagery. There are two levels of evidence that can now be evaluated: negatively, could these reports be due to faking or suggestibility; and positively, what converging lines of evidence are there to show the visual quality of what the eidetic child reports?

It may be that some of the children are deliberately faking the experience of eidetic imagery. Feldman's discovery that one of the Ss in her sample admitted faking because of an expected reward is particularly relevant. The reward in the case of our school children might be the special attention they received and the interruption of the daily routine by being excused from class. In fact, we also have some indication that at least one of our Ss was faking. The S was presented with a white card which had the sequence of letters YEUNCARXES on it. He had previously been presented with a card containing a sequence of 10 numbers. The following is taken from the tape recorded responses:

E - "Do you see anything?"

S - "I see a Y, an E, a U, N, R, and an S."

E - "Are there any spaces between the letters or are they right next to each other?"

S - "No, there are spaces."

E - "Can you tell me where the spaces are?"

S - "Right there" (points).

E - "Between what letters?"

S - "Between the 7 and (pause) the 5."

E - "Between the 7 and the 5 - do you see a 7 and a 5 now?"

S - "Oh! They're letters, aren't they?"

E - "Are you really seeing this or are you just remembering?"

S - "I'm remembering."

The question remains - how many of our children were also faking, but did not give themselves away by a slip of the tongue?

For fakers to convince us that they have eidetic imagery, they first must know our expectations on all of the tests and conditions administered to them, and second must be able to remember their own confabulations accurately. The example quoted above represents one case where the S was tripped up by his own faulty memory. There is some real possibility that at least one other of our good eidetic Ss is a faker part of the time, and we have so far been unable to trip him up. However, the majority of Ss provide us with enough internally consistent responses to fairly safely preculde faking as an explanation for their imagery-like reports.

As another alternative, perhaps these children are particularly sensitive to the demand characteristics of the situation and comply with the E's expectations because they are quite suggestible. Some children in general are definitely more suggestible than others. (For a discussion of this see Hilgard, 1965, pp. 287-291.) It may be that our procedures are indirectly a test of suggestibility and that our 8% may represent the percentage of school children who are quite susceptible to suggestion.

The possibility of suggestibility as an alternative explanation is very complex to evaluate. While we do clearly provide a suggestion (via the use of the afterimage tests) that the child will see something out there on the easel in front of his eyes, the child also has to know what it is that qualifies for good performance. There have been a number of children tested in the initial screenings for eidetic imagery who, we thought, were very susceptible to suggestion, and in fact were giving us responses that we felt were merely because they thought we wanted them. Like the data by Feldman in Ghana, such Ss are usually unmasked as suggestible as soon as you ask them any questions about their images.

However, when we examine our procedures more closely, it is clear that we are providing the children with many cues as to our expectations. The afterimage test was designed to suggest to S that he might see something on the screen after the picture was removed. This was done because initial pretesting had shown that many children thought the question was silly (they were right, of course - only to the eidetic children is it a reasonable one). Our asking the child, whenever he pauses in his report, if he can still see anything would be an adequate suggestion that he can say no, it has faded or is gone. (However, it has been noted that in some situations, nearly every child reports the same pattern of fading, in the same order, and in ways unanticipated by us.) Many of the other characteristics of the responses can be at least related to our suggestions hidden in the procedures or instructions.

Unfortunately, we have no independent evidence that the good eidetic children are or are not more suggestible. Our impression is that some are, but clearly some are quite the opposite. Further, while it is possible that many of the responses of eidetic images are merely the results of suggestibility, there are too many instances in which this hypothesis will not work: the responses are novel, or contrary to expectation; they are similar from S to S in the absence of demand characteristics in those directions, or are being made by Ss whom we strongly judge to be nonsuggestible.

These comments suggest that neither deliberate faking reports of images nor suggestibility due to the demand characteristics of the testing can account for the reports of eidetic imagery. Therefore, we need to evaluate those reports at face value. Can we? The semantic distinction between "out there" and "in my head", and the difference between "see" and "remember" may be quite unclear to some of the children.

These distinctions raise some of the most critical theoretical questions in all of perceptual theory. How is one's perceptual experience or awareness of an ongoing stimulation described (e.g. see Natsoulas, 1967, and Haber and Hershenson, 1969). Conversely, how can one tell the difference, when attempting to remember a stimulus, whether he is merely remembering it, or actually seeing an image of it in front of his eyes or in his head? Many adults, including psychologists, are not comfortable in making these distinctions about their own perceptual behavior. How then can we demand certainty from children and adolescents?

The upshot of this appears to be that we cannot depend solely upon the perceiver's report of seeing or remembering, nor upon the tenses he uses as a criterion for the presence of eidetic imagery. As a minimum, the eidetic perceiver should feel he is seeing an image, rather than merely remembering the stimulus. But that statement alone is not sufficient. Nor are inconsistencies in such statements clear evidence that the responses are so untrustworthy as to be rejected.

Fortunately, there are a large number of observations, comments, and experimental results which can be used as converging evidence of the visual character of the eidetic child's response. Thus, even if we are unwilling to trust his bald statement that he sees something in front of his eyes, we have some independent evidence that he is quite likely to be reporting a visual experience. This evidence has been mentioned through the monograph, but will be listed and briefly discussed here.

1. The duration of exposure determines the probability of an image appearing, even from a fully familiar picture which the child has seen many times.

2. Nearly all eidetic children use blinking as a mechanism to terminate their images. This is supportive not only because of its universality, but also because it is a visual rather than a cognitive control mechanism.

3. An eidetic image seems to be restricted to eye exposed. While this may be due to erasure through blinking, it suggests the child must be reporting what he sees, rather than what he remembers or knows, which need not be limited to one eye.

4. Even though the child may be familiar with the picture, he reports he can see an image of only those parts of the picture he has just looked at.

5. Conversely, he can remember parts that he cannot see in his image, suggesting that he has some basis for a distinction between seeing and remembering.

6. A few eidetic children report three dimensional images of three dimensional objects.

7. These same eidetic children can see reversals of orientation in their image of a Necker cube. While they are aware that reversals occur during examination of the cube itself, reporting them also in their image must be the result of seeing the cube itself in their image.

8. Nearly all children report their image "falls off" the edge and disappears when they attempt to move it from its original surface to another one. This is a visual description without doubt.

9. When viewing single letters which slide into place in a window, all eidetic children report that they move their image of each previously seen letter along the surface until they "fall off" at the edge.

10. All children report their images disappear in parts by fading, and that the nature of the fading process seems to be the same for all children, too.

11. When any child reports from memory, he does so with less confidence, more hesitations and "searching memory" than an eidetic child does when he reports his image. This is true even though there are no differences in the content of the reports.

12. Images of nonsense verbal material are no different in quality or content from meaningful words. Since memory representations clearly are different, this must be prior to memory.

13. Quality of the image report is clearly related to recency of scanning, and not to variables associated with verbal learning and memory research.

14. At least nonsense words can be reported as easily (if not more so) in the reverse order to viewing the letter. While this needs to be demonstrated for meaningful words as well, there is no reason to doubt it.

15. Images are most likely to be formed when S pays no cognitive attention to the stimulus and makes no attempt to memorize it. Imagery and memory seem opposites, not confounded.

It needs to be emphasized that most of the responses on this list came as a complete surprise to all of the observers and experimenters when the children first reported them. No references were made to phenomena such as these in the earlier literature. Therefore, little demand characteristics of the testing could have forced many of these comments, since we did not know them to be reasonable. Further, it is unlikely that all of the children could be faking these responses in the same way, since there could be nothing to tell them that this was a good or acceptable response.

As we have indicated, this list represents a mixed bag of evidence, though quite impressive through its range. We did try one direct experiment designed to isolate the visual character of eidetic imagery, one that would not and could not be contaminated with memory or faking, and could be given quickly and scored immediately.

The procedure we selected came from a suggestion of Siipola (personal communication) and is based on the hidden figure tests. The child is shown two pictures (see Figure 12a and 12b) designed in such a way that each is a rather sketchy but meaningful drawing. However, when the two are superimposed (see Figure 12c, which was never shown to the children) they make quite a different picture - one that is not predictable from either of them alone. The only way to see the composite picture is to look at the two separate ones together or to have an EI of the first one while looking at the second. Thus, the S scans the first picture, an ocean scene, for 30", the picture is removed and the second picture, some sea gulls, two small fish, and waves, is placed in front of the S. We have tested the whole sample using this procedure, and only four Ss out of the 23 performed as expected. One S's reaction was particularly convincing. After developing a good image of the first picture, he superimposed his EI over the second and, at first, persisted in reporting the various separate elements in each picture. Suddenly, with obvious surprise he reported the composite "face" and commented that the E was "pretty tricky" to have fooled him that way.

Insert Fig. 12 a, b, and c near here

This test is obviously a much stricter criterion of eidetic imagery than the original procedure in that it requires: (1) that the S have a complete EI of the first picture, since he would be unable to see the composite with only a partial EI; (2) that the S be able to superimpose his EI on the second picture; (3) that the EI persist long enough for the S to observe the composite. These probably account for the small number of children who scored positively on it. One crucial point in this test is that the composite picture must not be predictable from either of the two separate pictures. Children do not see a face in either picture alone, although a few graduate students have. Further picture sets also have to be developed. This new test idea should prove to be a more successful though stringent procedure for detecting EI and, hopefully, help to establish it as a unique perceptual phenomenon. It also avoids the set given by the afterimage test, as well as the priming effects due to the E's questions, since the only inquiry in the new procedure is to ask the child what he sees. In addition, no reliance need be placed on such questionable performance measures as accuracy of report, as the test will indicate immediately in an all or none fashion if the S is eidetic - either he reports the composite picture or he does not.

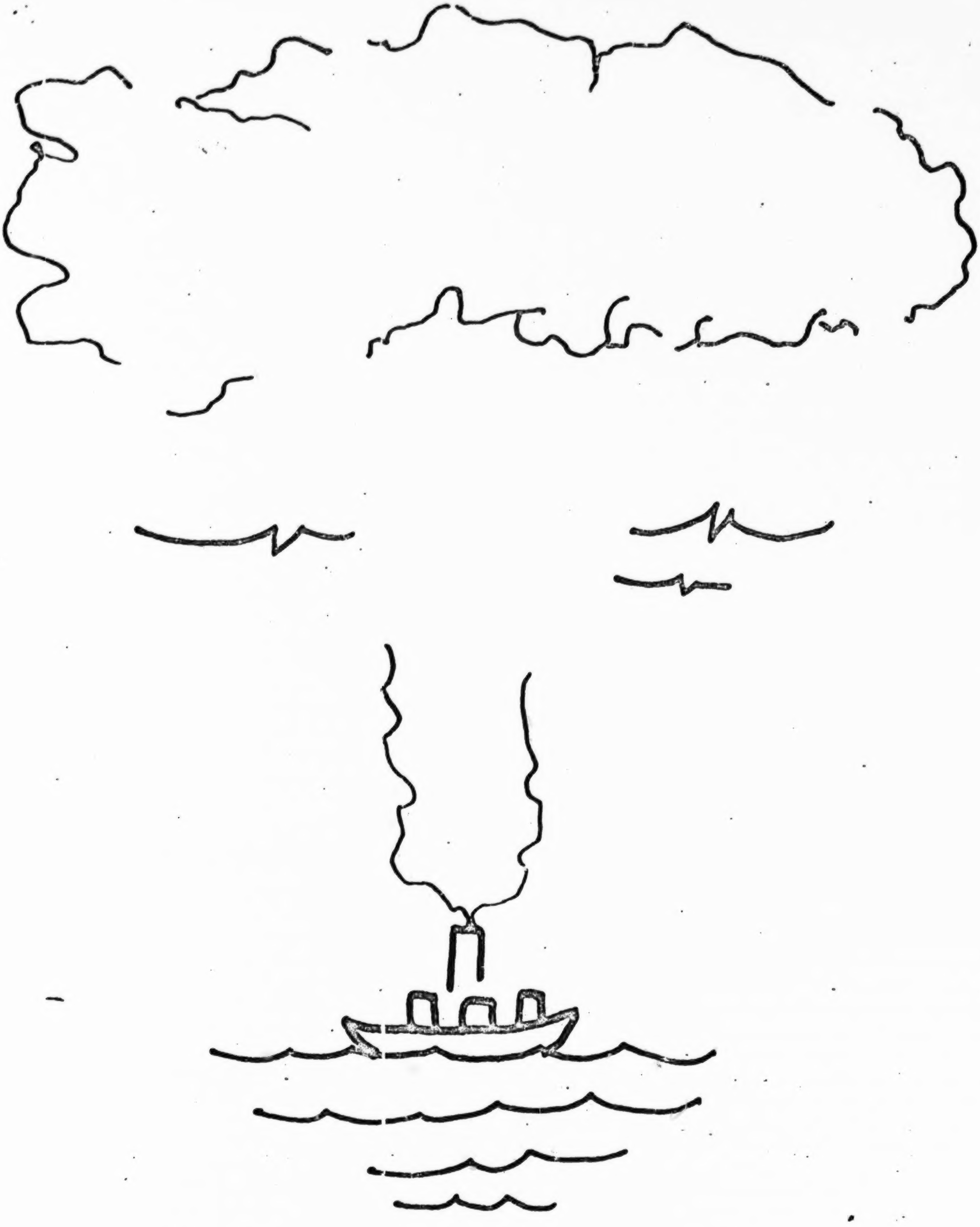
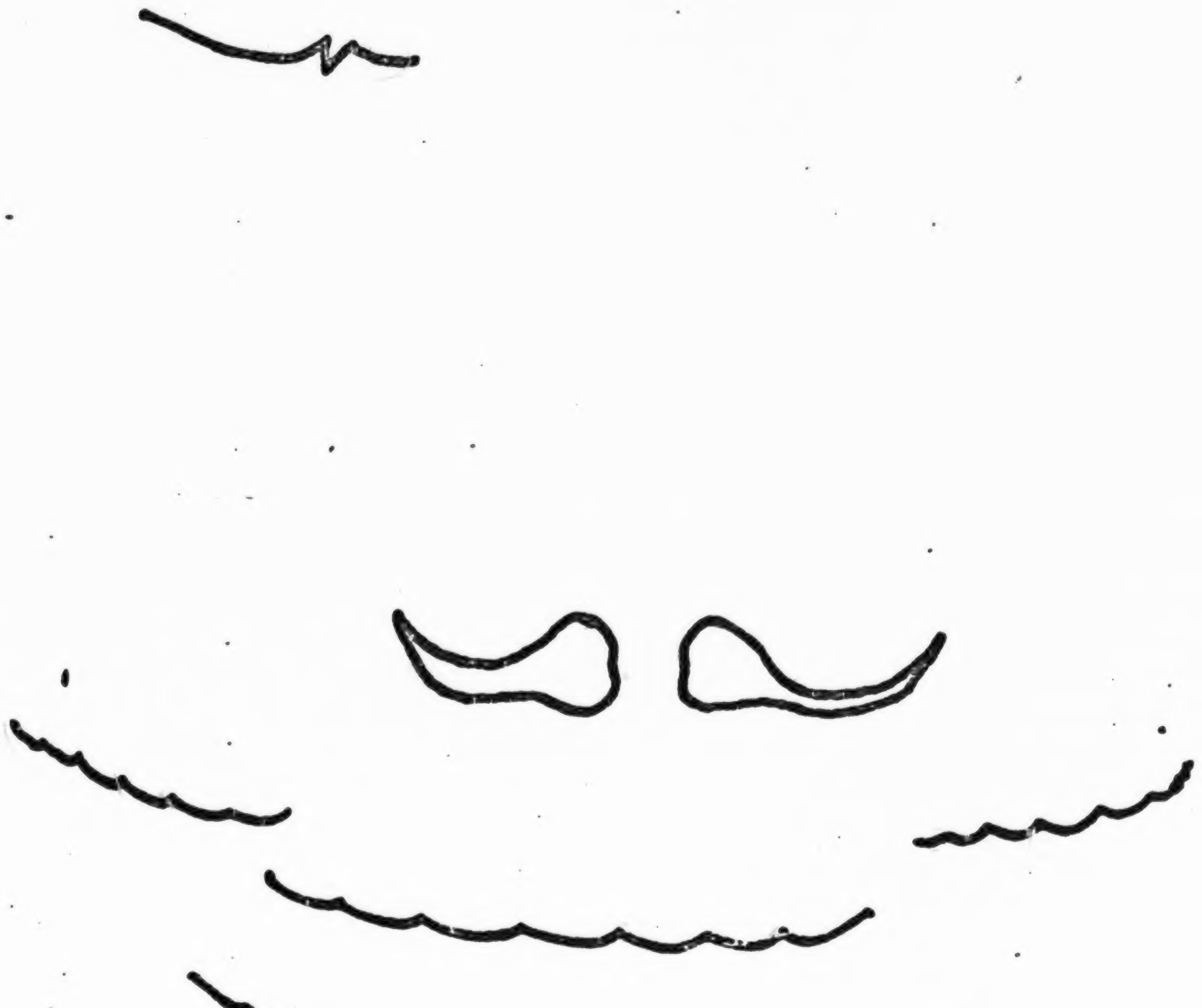
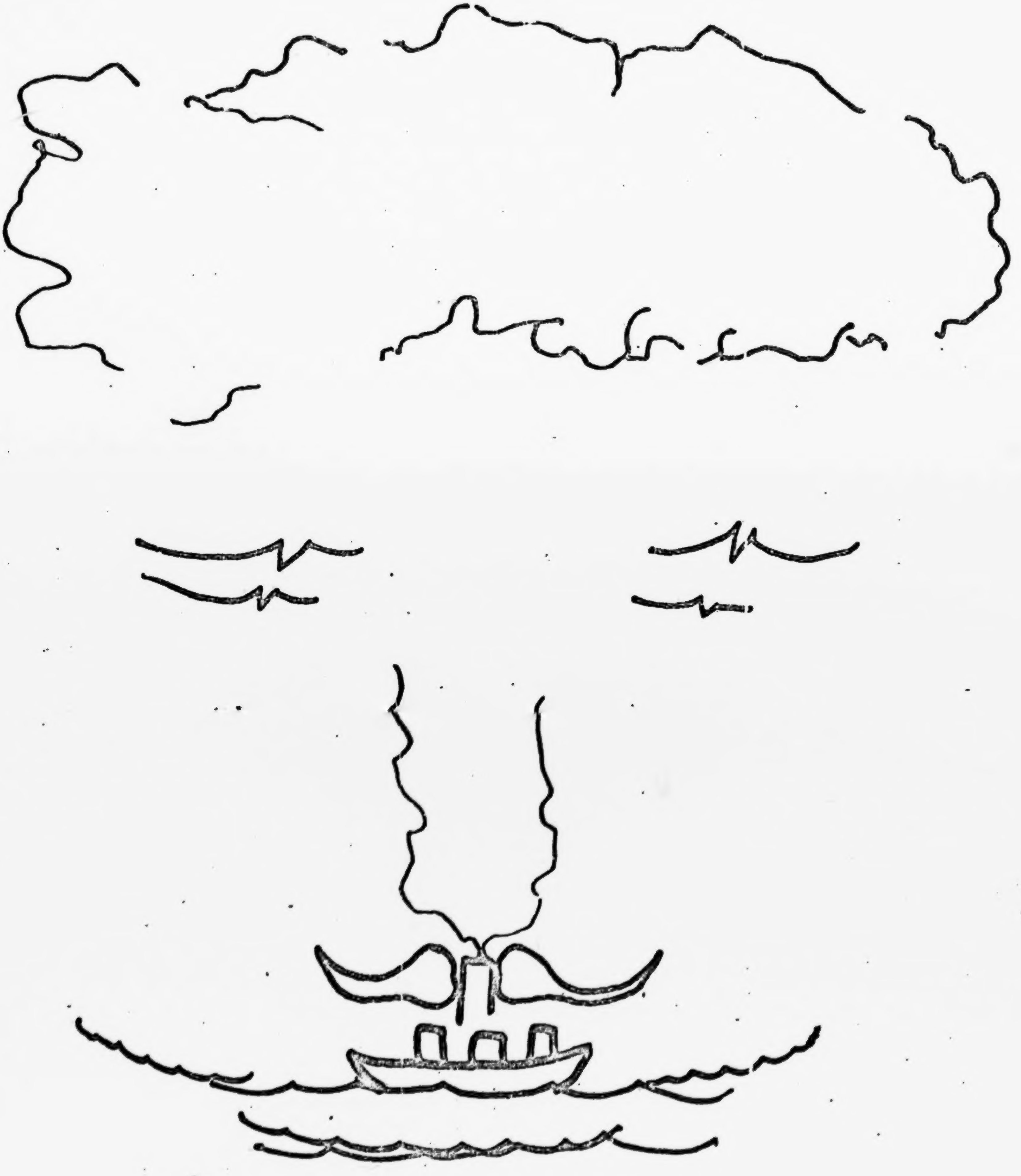


Figure 12. The non-verbal test for eidetic imagery. The upper and middle portions of the figure represent the individual stimuli used to elicit images. The bottom portion represents the composite picture when the two stimuli are sumperimposed.





The test cannot be faked either by deliberate deception nor through less conscious compliance with experimenter expectations due to suggestibility, since the demand characteristics of the new experimental situation are minimal - the composite is not predictable from the two separate pictures. The possible confusion due to the semantic distinctions between "see" and "remember" and "out there" or "in my head" also no longer pose a problem, because the S is not asked to make these distinctions - he need only describe what he sees on the screen.

It should be noted that Eriksen and Collins (1967) have used this technique ingeniously to study temporal integration and short-term visual storage processes. They constructed nonsense syllables out of dot-patterns in which the letters were made up of greater concentration of dots than the background. They then randomly assigned every dot into one of two categories. All of one category were placed on one slide, and the remaining on a second slide. When the two slides were presented simultaneously and superimposed, all the dots are combined and the nonsense word was clear. When either slide is on alone, no pattern can be ascertained. Thus, the ability of S to maintain a visual representation of the first slide while the second one is delayed can be measured by the accuracy of the S's report of the letters. Eriksen and Collins found 100 to 150 msec. to be the extent for adult college student Ss.

The next step for our test will be to develop other varieties of it, constructed in different ways, and tested with controls to verify that the composite is not identifiable from either half alone. Further, large group screenings are possible by presenting first one slide for 30 seconds, and then presenting the other immediately following removal of the first slide. Then each member of the audience is asked to write down what he sees when the second one was presented. This test can also be used with very young children, and even non-verbal humans and animals. All that is needed is a conditioned response to the composite stimulus. If the S is eidetic, he should be able to give that response even when the two halves of the composite are well separated in time.

In summary, we feel we can conclude that eidetic imagery is visual, and not merely a report of vivid memory. While our evidence to support is often roundabout, it seems utterly convincing.

Chapter 9

Summary

This monograph has presented procedures, results and observations on eidetic imagery based upon a number of years of work. That work is not finished by any means, since each contact with eidetic children stimulates questions rather than answers them.

The previous chapter reviewed the evidence regarding the visual nature of eidetic imagery. Earlier chapters presented results or observations on different characteristics of the imagery. We have left a few theoretical threads dangling to which we need to return briefly.

It is clear to us that eidetic imagery is not a general developmental phenomenon after age seven. It is still possible that very young children are all eidetic and that the majority of them lose this ability by age seven. We have no evidence on that. There are studies with very young children (ages 2 to 6) reported in the literature of the 1920's and early 30's, but since those studies used highly verbal measures and required the children to make complex semantic distinctions we tend to discount the validity of that work. Hence, the evidence seems moot.

However, it is not moot for children of school age. No developmental trend is present at all. Our longitudinal data are very stable over time and shows no correlations of eidetic imagery with chronological age or mental age of these children. The problem still remains to explain why these children we have identified as eidetic are different from the majority of their peers. Nearly all of our data to date are useless in making this distinction. Nothing seems to differentiate these few children from a random sample drawn from the same classrooms except this one perceptual skill, plus perhaps some differences in eye problems.

In addition to these developmental and the ideographic implications, some comments are in order about the relation of eidetic imagery to memory. One of the original instigations for embarking on this project was to examine eidetic imagery as an example of a very long short-term visual storage process and to see if such children could use that very long image to improve encoding and translation of visual stimulation into memory. The answer to this second question has been consistently no. The memories of eidetic children are not improved as compared to noneidetic children by the presence of eidetic imagery. Apparently they do not use the added time available during which they are inspecting an image of the figure to help them memorize it. In fact, we have found several clues to suggest the opposite--that active rehearsal and mnemonic concentration interferes with the adequacy and duration of the eidetic image. This might have suggested, except for earlier comments to the contrary, that eidetic imagery is a developmentally more primitive mode of information processing and replaced by one aimed at longer nmemonic representation as the child grows up. For this to be true, however, we should have found some age trend, or at least that a few of our eidetic children were developmentally more primitive on other information processing tasks. None of these corollaries seem to be true.

We are left with the conclusion that eidetic imagery is an exciting visual phenomenon in its own right and one that clearly needs further exploration and explanation, but that with the data at hand we cannot yet anchor it to other cognitive or perceptual functions.

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